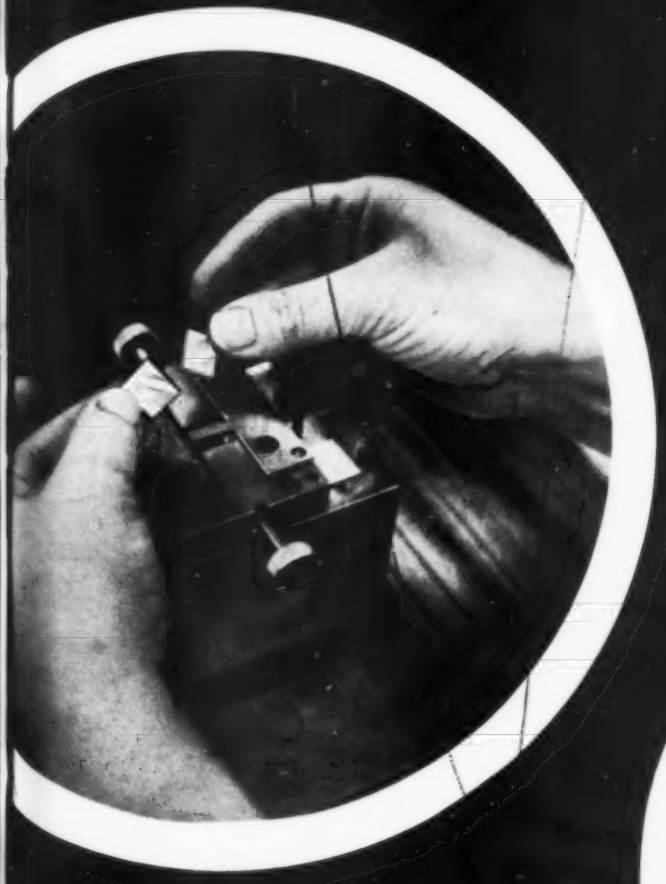
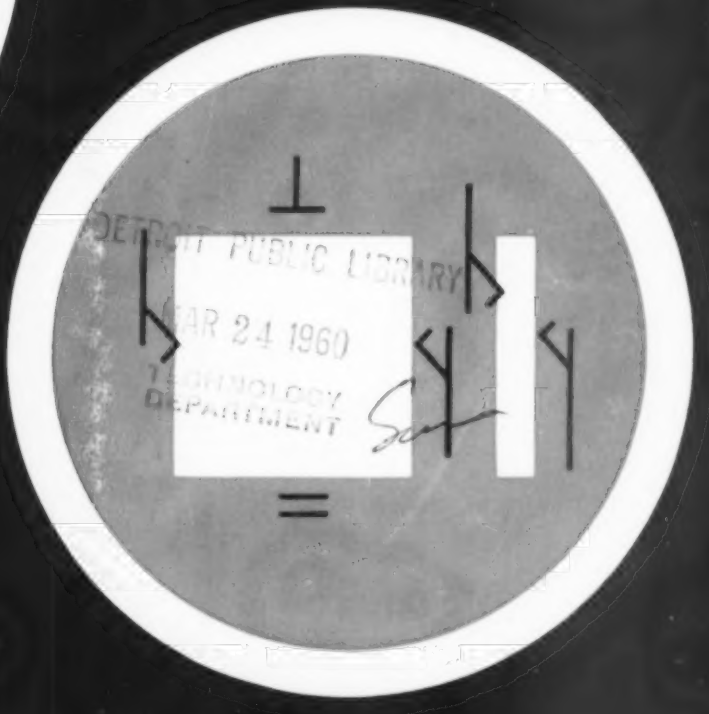
GRINDING and FINISHING

A HITCHCOCK PUBLICATION

March · 1960





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GRINDING FOR MAXIMUM LIFE AND MINIMUM MAINTENANCE - 34

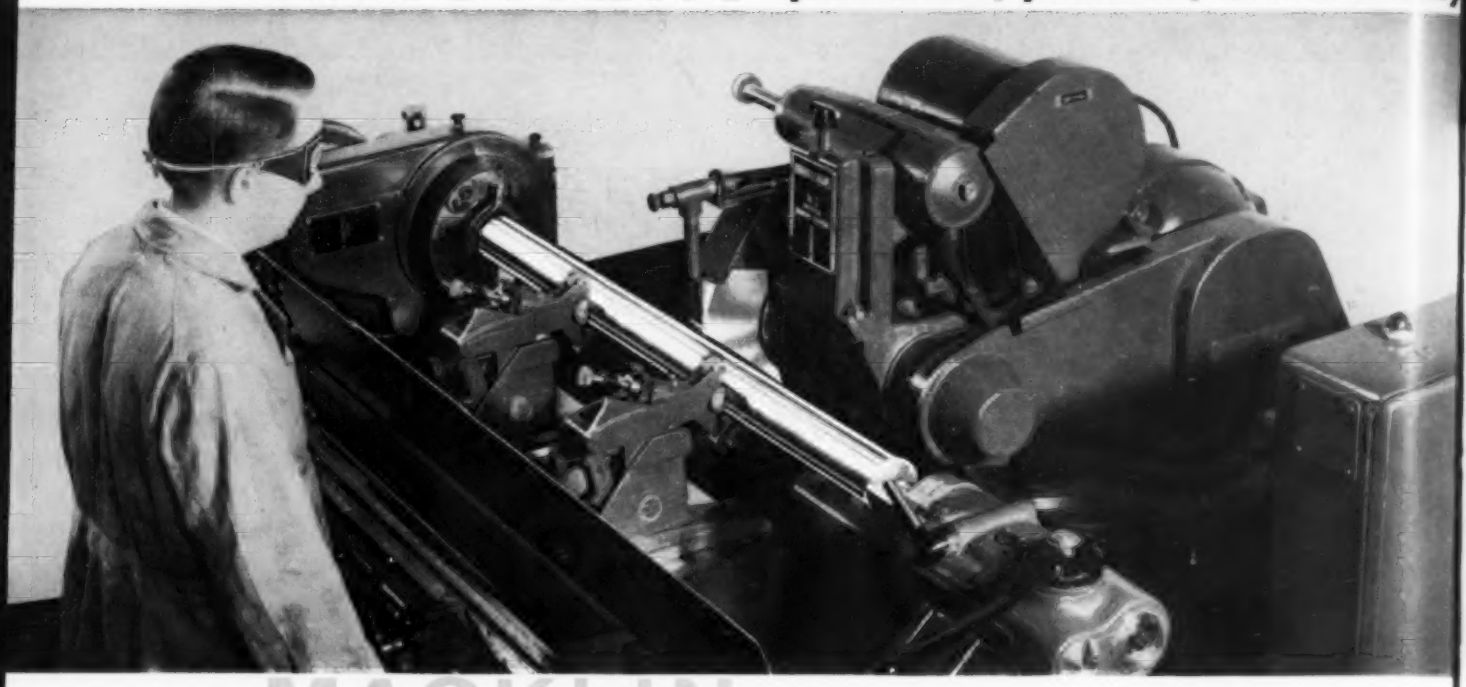
Two Rough for One Finish at Ford

Why Honing - Part II

Standard Time Data - Part IV

MACKLIN
MACKLIN
MACKLIN

In cylindrical grinding, too, for production, precision, and economy



YOU CAN DEPEND ON MACKLIN "Wheels of Profit"

Whatever cylindrical grinding method you use, traverse, plunge cut, or form, MACKLIN cylindrical wheels finish straight or tapered pieces to exact size and close tolerance.

Macklin cylindrical "wheels of profit" give you built-in wheel uniformity . . . precise wheel balance . . . good cornering ability . . . free and cool cutting . . . and longer wheel life.

Here's Proof of Performance

CARBON STEEL—"Extremely fast cutting on crankshaft pin bearings and still holds the radius. Highest production ever experienced." 29A462 04 V15.

ROLLS—"Rapid stock removal on roughing passes and still produces required finish easily without chatter on forged steel reduction mill rolls." A70 L II B2.

For complete information, send for Bulletin CLY.

GRINDING WHEELS

MACKLIN company Dept. 63, Jackson, Michigan

WHEREVER ABRASIVE OPERATIONS ARE PERFORMED

GRINDING and FINISHING

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Special to GRINDING and FINISHING

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March Cover: The left-hand insert shows a workholder used in grinding a refrigerator vane, the theme of the article on page 34. In the right-hand insert is a sketch of the part, marked with some of the conventional symbols for surface finish. Similar symbols are part of the "black-on-black" background.

Subscription rates: $6.00 per year in U.S.A. $7.50 per year elsewhere.
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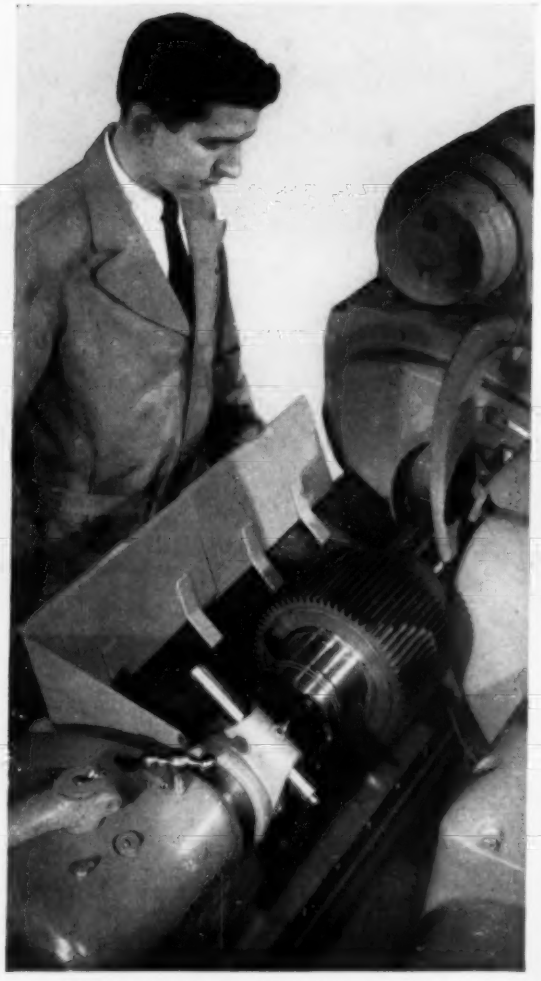
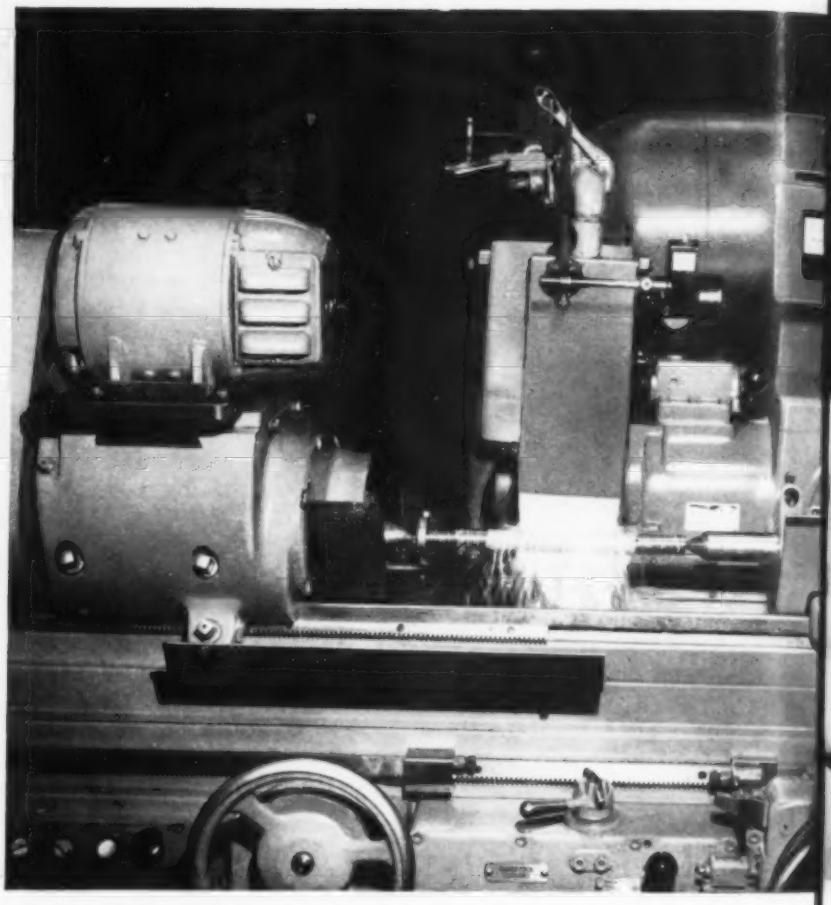


The HIGHEST

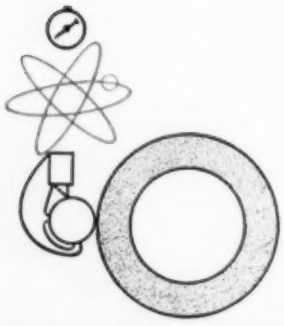
is ground on

LARGE DIAMETER SLEEVE GEARS and other expensive parts are precision ground with confidence on this CINCINNATI FILMATIC 10"R Plain Hydraulic Grinding Machine.

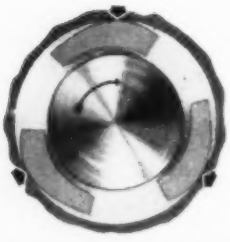
CINCINNATI



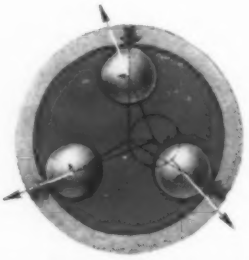
TRAVERSE GRINDING OPERATION on gear shifter control shaft is performed at Caterpillar Tractor Co.'s Peoria Plant on this CINCINNATI FILMATIC 10" x 48" Plain Grinding Machine, using automatic infeed and traverse grinding cycles.



AUTOMATIC AIR-ELECTRIC GAGE SIZING with its exclusive Cycle Time Stabilizer provides consistently high quality of sizing and finish without hand adjustments.



FILMATIC GRINDING WHEEL SPINDLE BEARINGS, an exclusive Cincinnati feature, eliminate spindle flutter. Run for years without maintenance or adjustment.



FREELY ROTATING STEEL BALLS automatically balance the wheel mount assembly when unclamped. Perfect balance is attained in a few seconds.

BUILDERS OF PRECISION GRINDING MACHINES: CENTERTYPE • CENTERLESS • MICRO-CE

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CINCINNATI FILMATIC Plain Hydraulic Grinders

Much of the craftsman's skill for producing extra high-quality work is incorporated in every CINCINNATI FILMATIC® Plain Hydraulic Grinding Machine. That's why even comparatively inexperienced operators can do an excellent job with a Cincinnati.

FILMATIC grinding wheel spindle bearings and automatic grinding wheel balancing are vital segments of this "built-in skill." These two exclusive features alone put Cincinnati grinders far ahead of the field, make them a first choice candidate to replace your productively obsolete machines. Other feature-advantages include anti-backlash device on the infeed screw, single lever control, automatic pickfeed infinitely variable from .0001" to .0025". Extra automatic equipment available for production work: air-electric gage sizing, push-button dual rate infeed, behind-the-wheel truing, gap eliminator, headstock drive plate positioning, and numerous additional items.

Information on the complete line of CINCINNATI FILMATIC Plain Hydraulic Grinding Machines will be found in the catalogs listed in the spec table. Write for copies, or ask Cincinnati's Grinding Specialists to assist you with your problems in quality and production.

CINCINNATI FILMATIC 10"R Plain Hydraulic Grinding Machine

There are four sizes in this line of fine precision grinding equipment:

Size	Between-Center Lengths	Catalog
6"R } 10"L }	18" and 30"	G-660-2
10"R } 14"L }	18", 36", 48" 72" and 96"	G-661-2

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GRINDING MACHINE DIVISION

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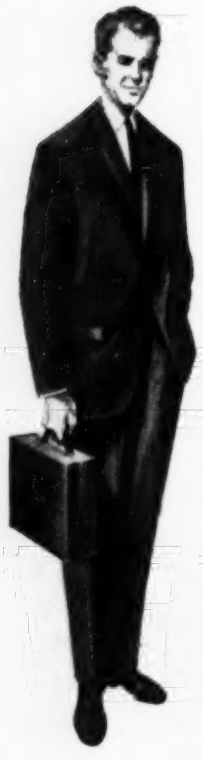
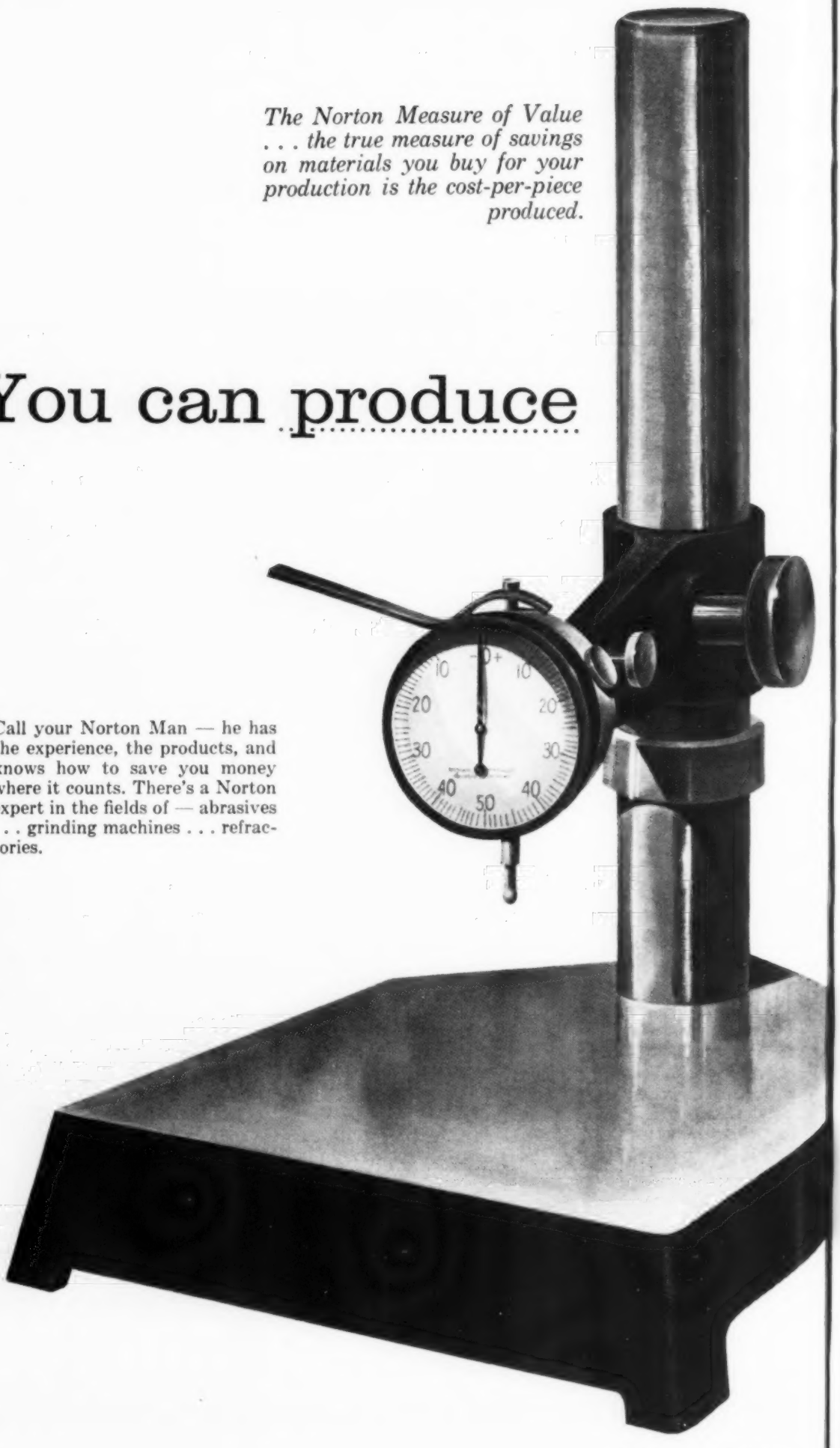
The Norton Measure of Value . . . the true measure of savings on materials you buy for your production is the cost-per-piece produced.

You can produce



Call your Norton Man — he has the experience, the products, and knows how to save you money where it counts. There's a Norton expert in the fields of — abrasives . . . grinding machines . . . refractories.



greater savings than you can buy

You can't recognize a value by its price alone. This is true of all types of grinding wheels and has special significance in diamond wheels in view of their high initial cost.

The price tag on a diamond grinding wheel may appear to be a good "buy", but the real consideration should be what will you get for your money?

Diamond wheels less expensive than Norton may save you money on immediate cost. But if the lower cost wheels do not perform their jobs efficiently or cause production delays because of poor quality or wheel misapplication — the price you paid is too much.

The only accurate measure of the value of any grinding wheel is how much it produces for you per dollar cost — not merely how much you paid for it. Here is why Norton diamond grinding wheels are worth more to you . . .

Norton Company introduced all three diamond wheel bond types — does all its own sizing and checking of diamonds — duplicates wheel specifications with constant accuracy. Whether the diamonds you use in carbide grinding are mined or man-made, Norton gives you the most advanced research engineering and manufacturing facilities in the entire abrasive field. And you get this great scope of detailed knowledge on a personal basis — your Norton Man.

Your Norton Man starts his career by spending a minimum of one year in a carefully planned training course in the Norton plant and a comparable period of training in the field. The Norton Man has an average of 15 years' abrasive experience in addition to the specialized training. He is the most knowledgeable man in abrasives that you can consult. Make him your consulting abrasive engineer.

Ask him to make an Abrasive Requirement Study for you. This study lists the correct specifications for each abrasive job in your plant to assure you lowest cost-per-piece produced. He is also available for complete field testing on specific problems. For example . . .

Your Norton Man can increase production by pointing out ways for effective wheel usage. He has the widest selection of grinding wheels in the industry from which to select the best wheel for new product grinding operations and for improving your current grinding jobs — both at the lowest cost. And with Norton grinding wheels you can be sure of precise duplication order after order.

Norton offers true abrasive economy. Economy that pays off in lower cost-per-piece produced. Call your Norton Man. NORTON COMPANY, General Offices, Worcester 6, Mass.

W-1957

NORTON
ABRASIVES

75 years of . . . **Making better products . . . to make your products better**

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. . . ARE DIAMOND GRINDING COSTS EATING YOU UP?

. . . if finishing costs are eating up your profits and you can't find help, let United States Diamond Wheel Co. show you how on-the-job "PROGRESSIVE SPECIFICATIONS" has saved others. PRESSURELOK® builds optimum performance into every diamond wheel—yet your carbide cutting costs may be reduced by using different type, size, grit or hardness of wheel from the one which you are now using. Here's how we can warrantee you top carbide cutting efficiency.

PRESSURELOK WORKS BEST!
PRESSURELOK (the Performance bond) makes the best of Diamond wheels because it scientifically combines warranteed amounts of graded Diamonds distributed in constant density throughout a perfect bond which wears uniformly at the ideal rate of Diamond usage.

be SURE . . . get
PRESSURELOK®

Write for our catalog No. 957 or call us at Aurora TWinoaks 7-9181 for "Progressive Specifications" on your job without any obligation on your part.

US UNITED STATES DIAMOND WHEEL CO.

835 ILLINOIS AVENUE AURORA, ILLINOIS

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Editor's Mail

Surface Grinder

In a recent news release on the Micromatic—Jones & Shipman model 1400 grinder—we erroneously stated that the "wheelhead and crossfeed are adjustable in increments of .00001"." The correct figure is .0001".

This portion of our release was run in the Equipment and Materials section on page 63 of your January, 1960, issue. We hope that this error did not mislead too many of your readers.

Micromatic Hone Corporation
Joseph Ellis
Advertising Manager

Affected readers please note. The New Equipment Editor would be the first to admit that such gremlins occasionally creep into his typewriter also. We are glad to call to the attention of our readers the correct degree of precision built into the grinder.

Grinding Wheel Safety

We are interested in obtaining material on the safe use and care of grinding wheels and discs, for our safety instruction meetings, and would appreciate any reprints of articles that you may have available.

We would also like to know where we can get the book, "There's a Killer in the House," which has been advertised in your magazine.

Thank you for any assistance you can give us.

Weyerhaeuser Company
Pulp and Paperboard Div.
Springfield Branch
Chester Tuttle
Maintenance Department

Enclosed are tear sheets of an article from the October 1959 issue of GRINDING and FINISHING, "How to Apply Safety to Portable Grinding," by D. S. Linton and Richard Allchin, together with an assortment of "Grinding Safely" pages and "Sam Safety" cartoons. Also enclosed are a number of Grinding Wheel Institute pamphlets on the subject.

Most grinding wheel manufacturers have safety material which is usually available on request. Films, of course, generally must be requested well in advance. We'd suggest that you contact your local distributors, or contact the companies directly.

As to the book, the closest we can come to this title is "Killer Among Us," by Robert Martin, which was reviewed in December. If this is the one you want, it is published by Dodd, Mead & Company, New York 16, N.Y., for $2.95.

Standard Time Data for Grinding

May we please have tear sheets of the "Standard Time Data, Part I," which appeared in the December 1959 issue of GRINDING and FINISHING.

North American Aviation,
M. H. Woolhandler
Librarian—Dept. 64
Plant Engineering

The above request is typical of the requests for additional copies of this revision of the most popular series that has ever been published in GRINDING and FINISHING. Tear sheets were of course sent, and we shall be glad to honor requests for any of the five parts of this series (the fourth starts on page 46 of this issue, and the fifth and final part will appear in the April issue) as long as the supply holds out.

Reprints of the entire series will be available upon completion of publication. In quantities up to 25, the price will be $1.00 each, with discounts on larger orders.

Worth Quoting . . . from:

Modern Industry and Patents, a talk by **Samuel Lenher, vice president, E. I. du Pont de Nemours & Company**

"Our nation has grown strong and our living has become good in large part with the aid of developments wrought by industry under the incentives of patents. Without those incentives and the protection they afford, our developments of the future would emerge more slowly if, indeed, they could be counted on to emerge at all."

• • •

POSITIVE DUPLICATION – EVERY TIME!

You can depend on a rubber stamp to print identical information time after time after time. You can also depend on the Positive Duplication of these tool-room cup (PD)* wheels—and all CINCINNATI (PD) GRINDING WHEELS.

HERE'S HOW (PD) IS ACHIEVED

To supply you with wheels of uniform excellence, Cincinnati's unique (PD) manufacturing process is unvaryingly regulated by 36 separate quality controls. For example . . . Humidity and temperature of the Wheel Mold Room are kept at the same levels every day throughout the year—an essential safeguard of (PD) uniformity.

RESULT: DEPENDABLE PERFORMANCE

Each (PD) reorder wheel gives you exactly the same good job as the original. Production goes up and stays up. Costs go down and stay down. This is the promise and performance—of Positive Duplication.

CALL CINCINNATI TODAY

Solve your grinding problems with the help of Cincinnati's factory-trained specialists. Their wide experience in job set-ups and grinding operations is at your service. Just call your CINCINNATI (PD) GRINDING WHEEL Distributor, or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

(PD) POSITIVE DUPLICATION

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GRINDING WHEELS

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

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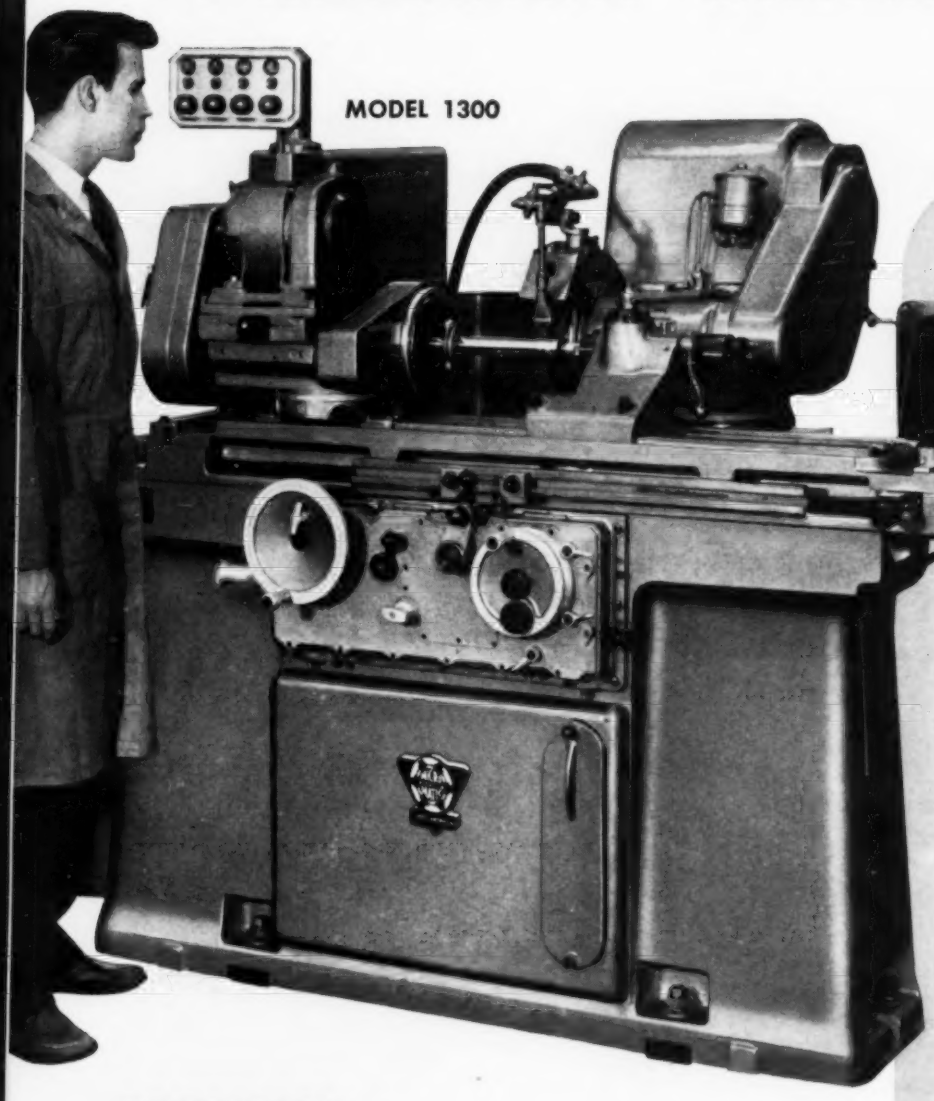

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HONE CORPORATION
DETROIT, MICHIGAN

MANUFACTURED BY
JONES-SHIPMAN
LEICESTER, ENGLAND

FEATURES:

- Roundness to .00001″
- Surface finish to 1 micro-inch
- Parallel grinding to within .00025″ in the center over 24″.
- Shockless table reversal at all speeds.
- Table reversal accuracies: .0005″ for models 1300 and 1310, and .001″ for model 1305, at maximum table speeds.
- Micrometer movements on table and cross traverse.
- Trouble-free, low-pressure hydraulic system.
- Nitralloy wheel spindle running in plain bearings.
- Super-accurate workhead spindle in selected plain bearings.
- Minimum stroke of .020″ at maximum table speed.

PRECISION + VERSATILITY + EASY OPERATION =GREATER GRINDING EFFICIENCY

Models 1300, 1305 and 1310 are precision grinders that offer unusual versatility and ease of operation. They assure high grinding efficiency on such operations as: external cylindrical or taper, internal, and cutter or tool grinding. Of simple, accurate and rugged design, these grinders are available in three capacities: 8″ swing and 18″ between centers; 10″ x 27″; and 10″ x 40″.

SEVERAL types of wheelheads of proven design are available. Also, special attachments to efficiently meet any grinding requirement can be furnished.

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Off-hand belt polishing means faster production for a wide variety of products

Finishing operations using **BEHR-MANNING** coated abrasive belts are resulting in better quality and greater production for products of all sorts of shapes, sizes, uses and materials. Cost and time-savings in many cases are extraordinary. *If you would like to arrange a group showing of our comprehensive and documented movie, "Better Offhand Polishing with Coated Abrasive Belts"* write Dept. GF-3.

8 steps were eliminated finishing cast brass spouts by changing to belts. Parts are roughed and polished in just two operations.

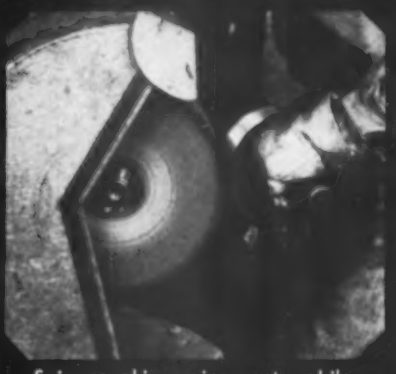
Finishing costs dropped from 4½ cents to 1 cent on these golf heads, and production increased to 50 heads per hour.

25% saving in finishing time with belts for these power-tool motor housings. Four finishing steps were reduced to two.

Proper fixturing plus belt finishing increased production 50% for these automobile wrench sockets.

With this fixture, operator polishes 336 tapered steel table legs per hour. The legs feed across the abrasive belt.

600 of these knurled cap screws for electric fans are polished per hour by one operator, and ready for final chrome plating.



Spin-roughing zinc automobile parts prior to painting. Parts are held on a wheel-like wooden form that rotates.

Deburring brass armatures faster with 80-grit RESINALL METALITE belt running over a compressed canvas contact wheel.

With one pass, operator now grinds the radius on refrigerator compressor crankshafts, using specially-mounted contact wheel.

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TROY, NEW YORK

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"We break every rule in the book

"We have one of the toughest testing programs in the entire industry. It breaks every safety rule that's ever been invented so that we can find out just how much punishment a grinding wheel can take.

"The test shown here, for example, is for heavy-duty snagging wheels that are used in foundries and steel mills. The wheel under test is locked into a steel drum that's built like a gun turret. Then the wheel is spun at speeds far beyond anything you can get with even the latest production equipment . . . until it finally explodes. Such tests as these have helped us formulate snagging wheels for manufacture with a *safety factor higher than ever before.*

"This, of course, is only one of the more spectacular tests we make on all Bay State wheels. There are many others that probe the ultimate strength factors of every type of wheel under extremes of heat, vibration, tension, torsion and many other variables. And the purpose of these tests goes beyond ordinary standards, too. We are not just trying to produce *acceptable* wheels. We are out to make the best wheels that can be made . . . no matter *what kind* of wheels they may be!

"The record shows that BAY STATE quality also leads to lower grinding costs. You'll find your Bay State distributor or direct representative completely equipped and thoroughly trained to analyze your grinding operations for optimum performance and minimum cost."

"Better grinding at lower cost . . . that is our business."

for YOUR SAFETY . . ."

Elden L. Auker, Marketing V. P. of Bay State Abrasives, is a man who knows the industry through years of experience both in working in the field with Bay State customers and from close association with the research and development programs at Bay State's manufacturing headquarters in Westboro, Mass.

BAY STATE ABRASIVES

BAY STATE
WHEELS of PROGRESS

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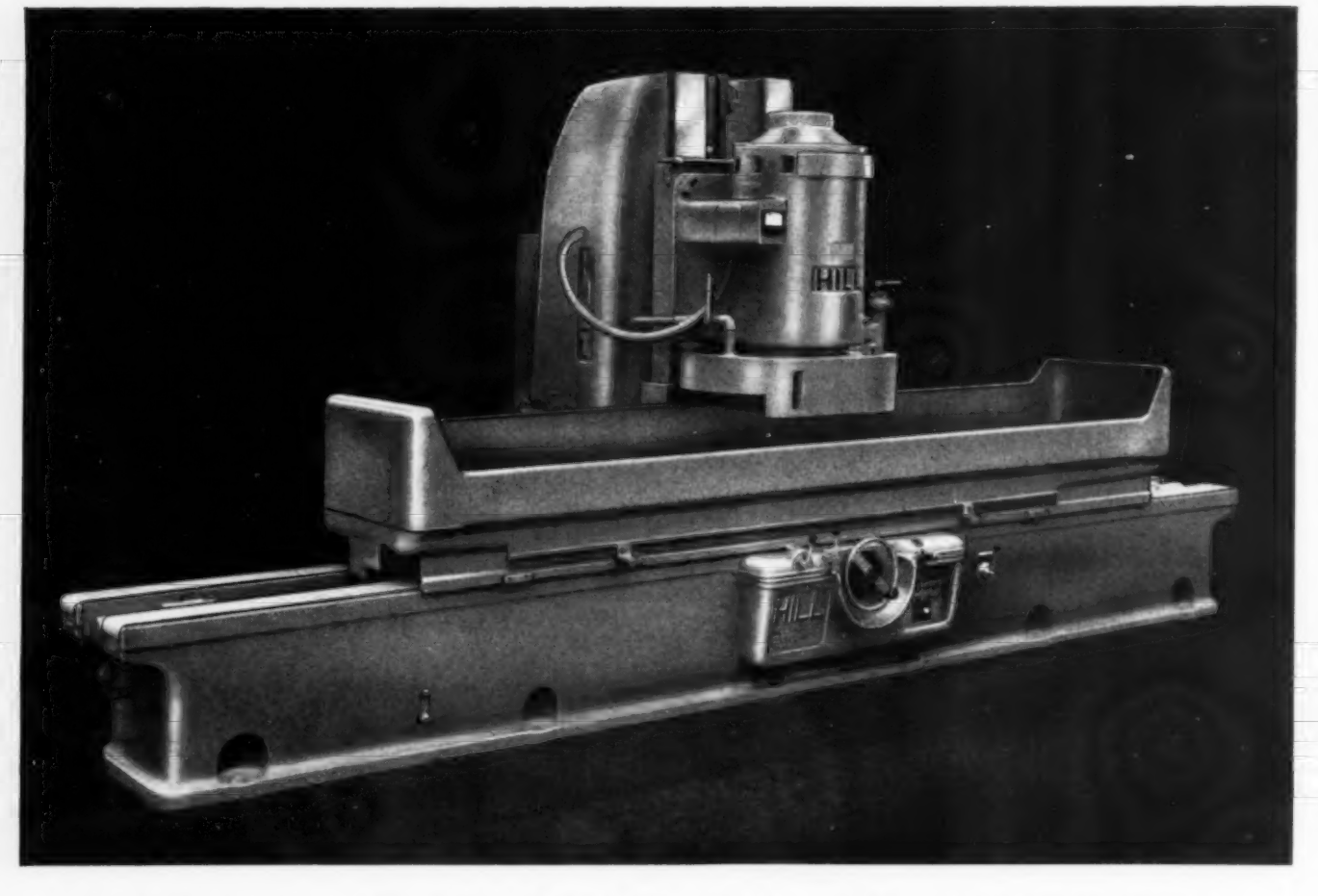
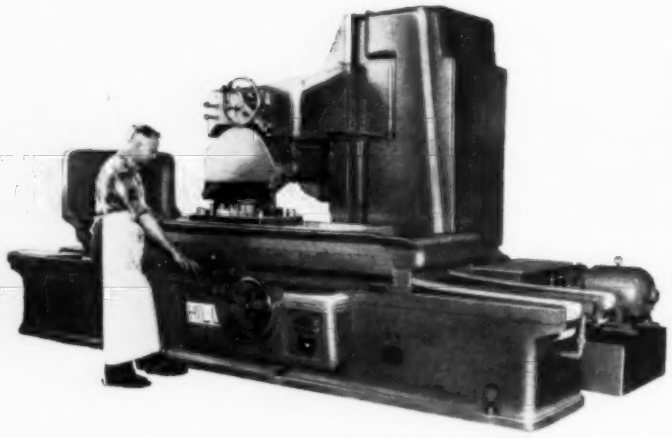


Hill Grinder ELIMINATES MILLING OPERATION



For grinding to extremely close tolerances on flats, angles, irregular and special shaped surfaces the HILL Horizontal Spindle grinder is recommended.

Expensive, time consuming milling operations can be eliminated in finishing die blocks, bolster plates etc. with the new HILL Vertical Spindle Hydraulic Surface Grinder. Equipped with either 75 or 100 HP main spindle motor, the segmented grinding wheel provides fast stock removal and produces an accurate finish in approximately half the time required for a combined milling and grinding operation.

The HILL fully hydraulic reciprocating table is adaptable to a wide variety of stock sizes having flat surfaces. Table widths are 18″, 24″ and 30″ with table lengths from 5 to 20 feet.

HILL ACME TOOLS FOR INDUSTRY

MMT-PE

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WHEREVER ABRASIVE OPERATIONS ARE PERFORMED

Editor's Page

MARCH 1960

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So, You Want Quality

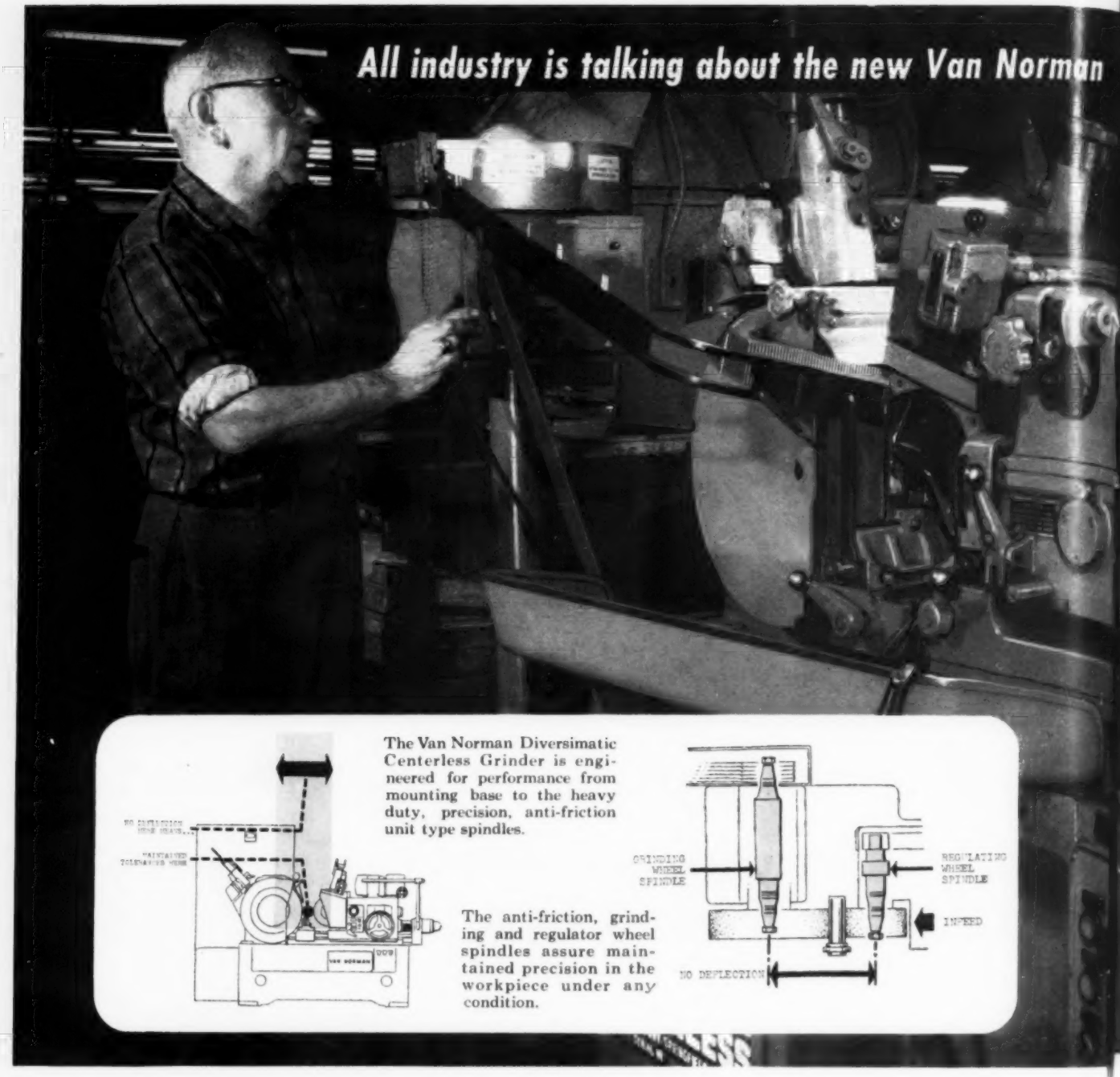
The buyer, the great equalizer, the final decision, has finally made a sound which adds up to quality. Words from the stock holders' spokesmen of the paneled board rooms and the "Hidden Persuaders" of Manhattan's grey flannel street lose their effect once the buyer has bought a product that lacked quality. The fact is that this attempted to sell high style and gimmicks while giving only lip service to quality has developed nothing more than temporary sales and complexes which the buyer will not get over for some time.

It has been a long time coming, but the buyer has finally spoken. During a recent visit to an automotive plant, the process engineer's comments which were almost a complaint, gave proof of the buyer's sounds being heard and coming down the pike. His remarks were, "Quality control is the management's first objective now. They are closing the tolerances, which is not so bad except they are also asking for a finish on surfaces half of what they were or add a finish requirement where it wasn't requested before."

These requests can only mean more grinding and finishing. This then becomes another indication of the growing importance of our industry. But what about the guy that has to get the quality for the buyer? He does deserve some consideration. After all he is the guy who has to produce the quality. It takes no special talent to change numbers or add a finish mark to a drawing or send out a directive to hold everything closer. But, it takes time and skill to accomplish all of these changes.

Let's then be realistic about quality. The buyer is right, he should have quality. And it is the job of processing and production to provide quality, but let's not get carried away with a grandiose sweep of the hand that cuts tolerances and finishes and thus supposedly provides quality. Quality does not come from mere changes. It comes from engineering, management and production getting together. It must be worked out jointly. Let's give the buyer quality. He deserves it. Let's not just give processing and production headaches.

M. M. Patterson



The Van Norman Diversimatic Centerless Grinder is engineered for performance from mounting base to the heavy duty, precision, anti-friction unit type spindles.

The anti-friction, grinding and regulator wheel spindles assure maintained precision in the workpiece under any condition.

BENDIX AVIATION BOOSTS SYNCRO SHAFT

VN Centerless Grinding cuts production operations, inspection time and

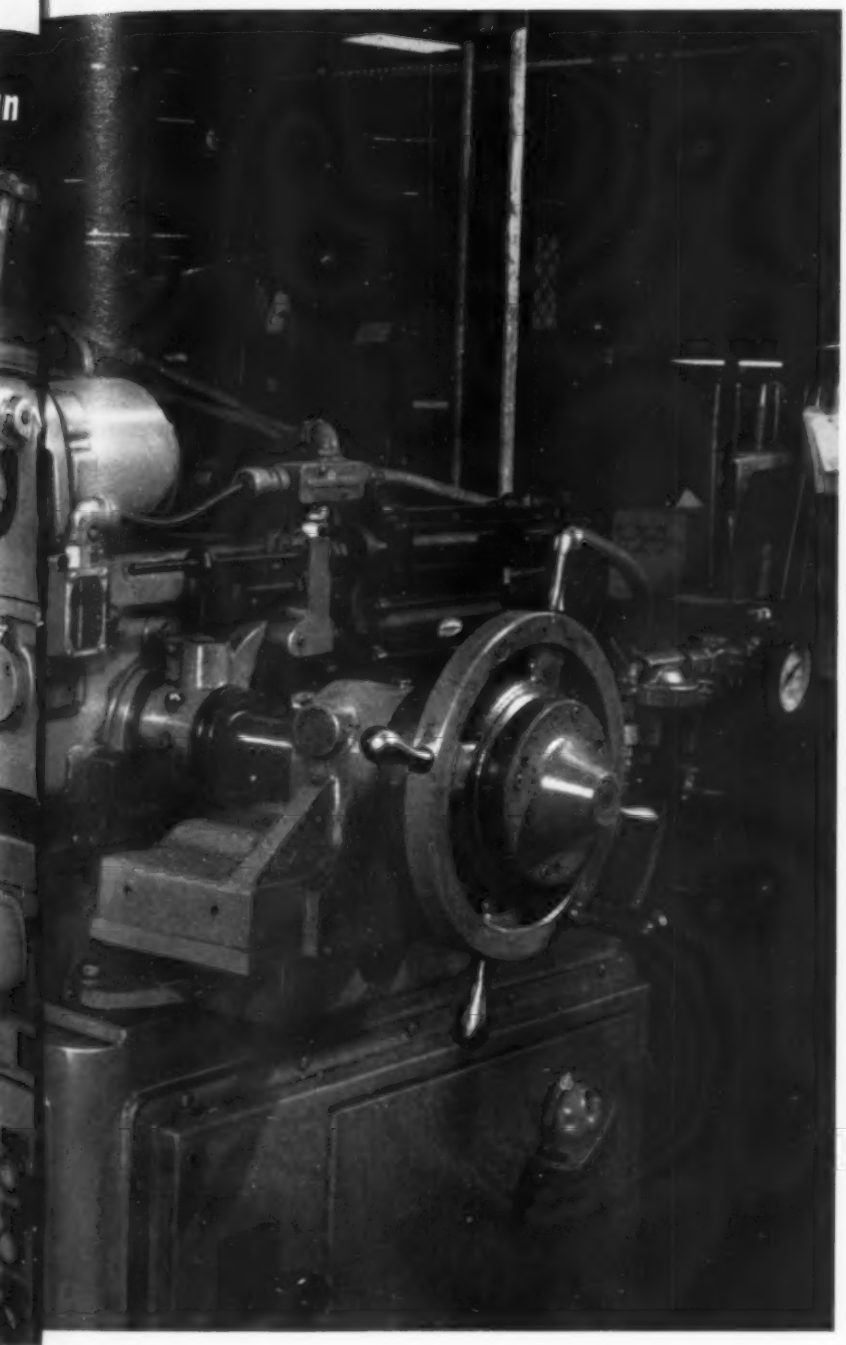
Bendix boosted hourly production of Autosyn syncro shafts to 600 per operator with a Van Norman Centerless Grinder. One Van Norman Centerless Grinder (with a specially developed automatic feed) replaced two manually fed machines, which produced only 50 shafts per hour.

Annual Savings $9,000—eliminating the need for highly skilled burnishing operators—100% inspection was eliminated. Concentricity control and improved tolerances were obtained with the Van Norman Centerless Grinder.

Faster Set-Ups . . . Increased Production . . . Greater Accuracy. The Van Norman Centerless Grinder is specifically engineered to produce more precision grinding per operator per work shift . . . designed for in-feed work.

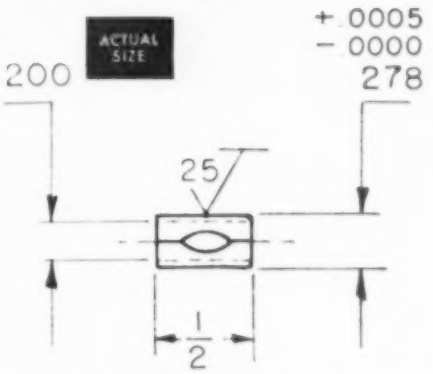
VAN NORMAN

SPRINGFIELD 7, MASSACHUSETTS



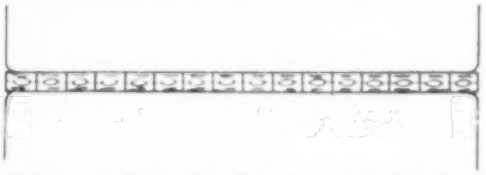
Another typical Van Norman centerless grinder cost-saving application

CUSTOMER'S PROBLEM:



Grind the .278″/.2785″ with an RMS of 25, or better, at a rate of 300 or more pieces per minute. The parts are rolled seamed carbon steel hardened to 56-58 Rockwell C. Machine to be hopper fed. Size to be held whether wheels are full of parts or scattered.

VAN NORMAN SOLUTION:



A No. 2-C Centerless Grinder using eight inch face wheels and vibratory hopper with a maximum feed rate of 410 pieces per minute was used. A P & W Air Gauge set limits of high and low to .0003″ or .0002″ less than allowed.

THE RESULT:

Van Norman ground 250 lbs. of parts—or 60,000 pieces—at 410 pieces per minute. Faster time was possible but the hopper could not handle a faster rate. All of the parts were ground without redressing the wheels. Size was held to well within the .0003″ allowable limits. Finish held to less than 15 RMS. Variation from piece-to-piece was not discernible. Wheel wear required a .0001″ compensation every five minutes to keep the .00025″ tolerance.

Customer reaction: complete satisfaction.

PRODUCTION 1200%

material cost — saves $9,000 annually

thru-feed work, crush form grinding and profile work. The Van Norman Centerless Grinder is rugged, and designed for heavy duty, long run production.

Send For Free Booklet—"Centerless Grinding," your local VN Franchised Distributor will be happy to discuss how VN Centerless Grinding may increase production and cut costs for you . . . call him NOW!

MACHINE COMPANY

A DIVISION OF VAN NORMAN INDUSTRIES, INCORPORATED

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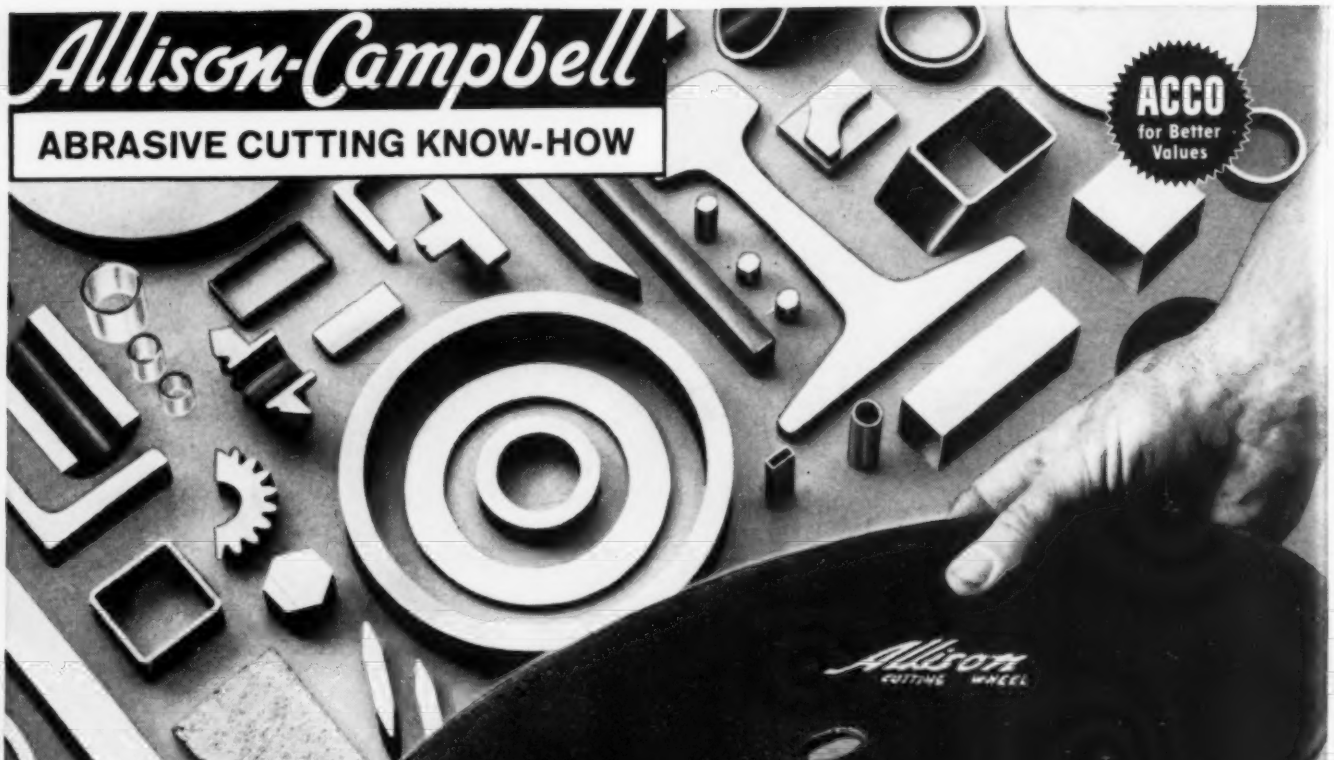

How Allison Wheels help you get

Quick, accurate cuts on almost any material or shape

• Abrasive cutting can give you *cleaner* cuts, *faster*—on almost any material from titanium to fire brick. But only when you use the proper cut-off wheel can you get the best results. That's where your ALLISON-CAMPBELL Field Engineer can help. Show him your cut-off problem, and he can select the ALLISON wheel that will cut your metals and other hard materials at speeds of just a few seconds per square inch—fine finish, without burn and with little or no burr—accuracy within close tolerances.

No matter what cut-off problem you have, chances are the right ALLISON wheel will do the job more quickly, less expensively, and more accurately than any other cut-off method. There's a complete selection of ALLISON wheels for every abrasive cutting application.

• • •

Resinoid bonded wheels are designed specifically for dry abrasive cutting machines. They cut at rates of 3 to 5 seconds per square inch, will cut 2" x 2" hardened steel on a standard chop stroke machine in 16 seconds.

Rubber bonded wheels are used primarily for wet cutting operations to obtain the finest quality cuts on all types of steel, alloys, titanium, glass, and plastics. Rubber bonded wheels are sometimes used for cutting tubing dry with minimum burr.

Masonry cutting blades, including reinforced types, are available for both wet and dry cutting of such materials as fire brick, concrete block, glazed tile, and transite. Use of the proper ALLISON wheel can reduce down-time for furnace repairs by speeding the installation of refractory brick.

Fiberglass reinforced wheels provide high cutting speeds while giving extra strength for many foundry cutting jobs. They're available in both resinoid and rubber bonded types, help prevent accidents and costly breakage.

GET THE COMPLETE STORY! Write for **Bulletin DH-214** for detailed information on abrasive cutting techniques, and the wide selection of ALLISON wheel specifications. ALLISON wheels are available 3" to 34" diameter, .006" to 3/16" thick. And remember—your ALLISON-CAMPBELL Field Engineer can give you specialized help. His know-how is your assurance of the efficient, accurate, and economical cutting you can expect from modern abrasive cutting techniques.

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Allison-Campbell Division • American Chain & Cable Company, Inc.

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You Asked . . .

ARTHUR RAKESTRAW
Contributing Editor

Selecting Wheel Dressers

• How do you determine when to use a diamond and when to use a Huntington-type dresser on a grinding wheel?—H. H., Waukegan, Illinois.

The Huntington or star type dresser, which consists of a number of pointed discs mounted loosely on a pin and separated by steel washers, is basically a wheel dresser, not a truing tool. The rolling penetration of the projections removes surface loading and dulled, glazed grain, leaving the abrasive surface comparatively open and rough. It does not insure absolute wheel truth.

On machines such as the vertical spindle surface grinders and disc grinders, this type of wheel dresser is well adapted. It removes dulled grain and also reduces the amount of surface grain in contact with the work, thereby producing a faster, freer cut on finishing operations.

Diamonds are used as a wheel truing medium, guaranteeing absolute wheel symmetry and wheel face shape. In performing precision truing it also accomplishes a dressing action, but in a precision manner.

Diamonds should be used for all precision truing operations where finish is of prime importance, with the exception of such uses as are listed above. The Huntington type dresser is primarily designed to rough off large amounts of abrasive material and to rough-true wheels on non-precision operations.

Grit Size and Finish

• Can you get as good a finish with a 46 grit wheel as you can with an 80 grit wheel? As you can with a 200 grit wheel? In other words, over how wide a range of grit sizes can you get the same finish?—S. A., Chicago, Illinois.

This question could be answered simply and directly by stating that finishes improve as the grit size becomes finer and that there could not be a range of grit sizes which would produce identical finishes.

It is likely, however, that there was a definite reason for propounding this question, and that the questioner, like many readers, could think of a set of conditions where such a statement would not be true. Such a statement could easily open up a round of endless discussion, because there are certain conditions of operation, on specific materials, where such an assertion could be refuted.

Because of the multitude of variables associated with the grinding industry, it would be difficult to arrive at definite conclusions unless the discussion were confined to a single set of conditions.

Following are some of the variables that play such an important part in the production of finishes:

Abrasives. The number of different kinds of artificial abrasives is legion. The variations of the two main kinds, aluminum oxide and silicon carbide, differ widely in such important characteristics as hardness, toughness, shape, friability and structure. All of these are sized by standard screens that designate the grit size.

Combination of grits. Abrasive wheels are seldom manufactured from only one grit size, even though only one is designated in the wheel marking. For purposes of stronger, more stable design, a combination of grit sizes usually go into the make-up of the wheel.

Design. The general design of a grinding wheel, its grain spacing, bond strength, and even its dimensions, have considerable influence on its grinding action.

Work Material. Materia's being processed differ widely in their resistance to grain penetration and require special attention in the selection of grain types and grit sizes.

Dressing and tru'ng methods. The kind of tool, whether diamond or abrasive, the procedure used, and the rate and speed of truing traverse are of extreme importance in the preparation of the grinding wheel face.

Considering the possible combinations of the above variables, and the fact that there are several possible ways of performing a given grinding job, it would be hazardous to make any conclusive statements.

However, grinding operations might for convenience be divided into two classifications:

(A) Grinding finishes which depend largely on the technique of dressing.

(B) Finishes which result entirely from the grit size and natural wheel face breakdown.

By far the majority of grinding operations fall under the first category. The finish is primarily the product of the wheel dressing method. Grit size, although important, is secondary.

This is particularly true of the soft, ductile materials and of the more

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scratch-resistant soft and medium-hard steels.

For example, cylindrical grinding of aluminum is best performed with coarse grit silicon carbide wheels, very finely diamond dressed. If proper coolant is used, very refined finishes can be produced with practically no wheel wear. The large voids between the coarse grains provide ample clearance for the grinding chips, thereby eliminating surface loading.

As the materials become harder, finer grit sizes are selected to provide a greater number of surface grains to contact the work. Inasmuch as grain penetration is reduced, the rate of production must be maintained by applying a greater number of grinding particles to the work surface.

Grinding operations which depend on grit size and wheel face breakdown to provide cut and finish are not too common. The grinding of large cold mill steel rolls is one instance of an operation where grit size and wheel grade are most important in arriving at the required finish.

A somewhat newer application is the centerless rough grinding of rod stock and hard automotive wrist pins. Wheel face breakdown provides sharp grain for fast cut, and wheel wear is compensated for by wheel infeed. No wheel dressing is required.

Outside of such operations as those last described, grit size as such is not the determining factor in the production of finishes.

Coated abrasive belts for polishing sheets offer the best comparison of the effect of grit size on finish. Here the resilient cloth back permits some movement of the grit, and depth of scratch may be somewhat reduced by the receding grain.

Honing operations make use of self-dressing sticks to produce fine finishes on bores. The operation of the machine permits adjustments for change in oscillation with reference to the rotation, thereby making possible a wide variation in finish patterns. Grit size and grade are most important.

This by no means covers the possibilities in finishes resulting from the removal of metal with abrasive grain. The discussion may, however, have refreshened your mind on some of the reasons why grinding produces such wide variations in the finished results.

• • •

Why General Electric Man-Made diamonds are better for you

HEAVY-DUTY WORK?
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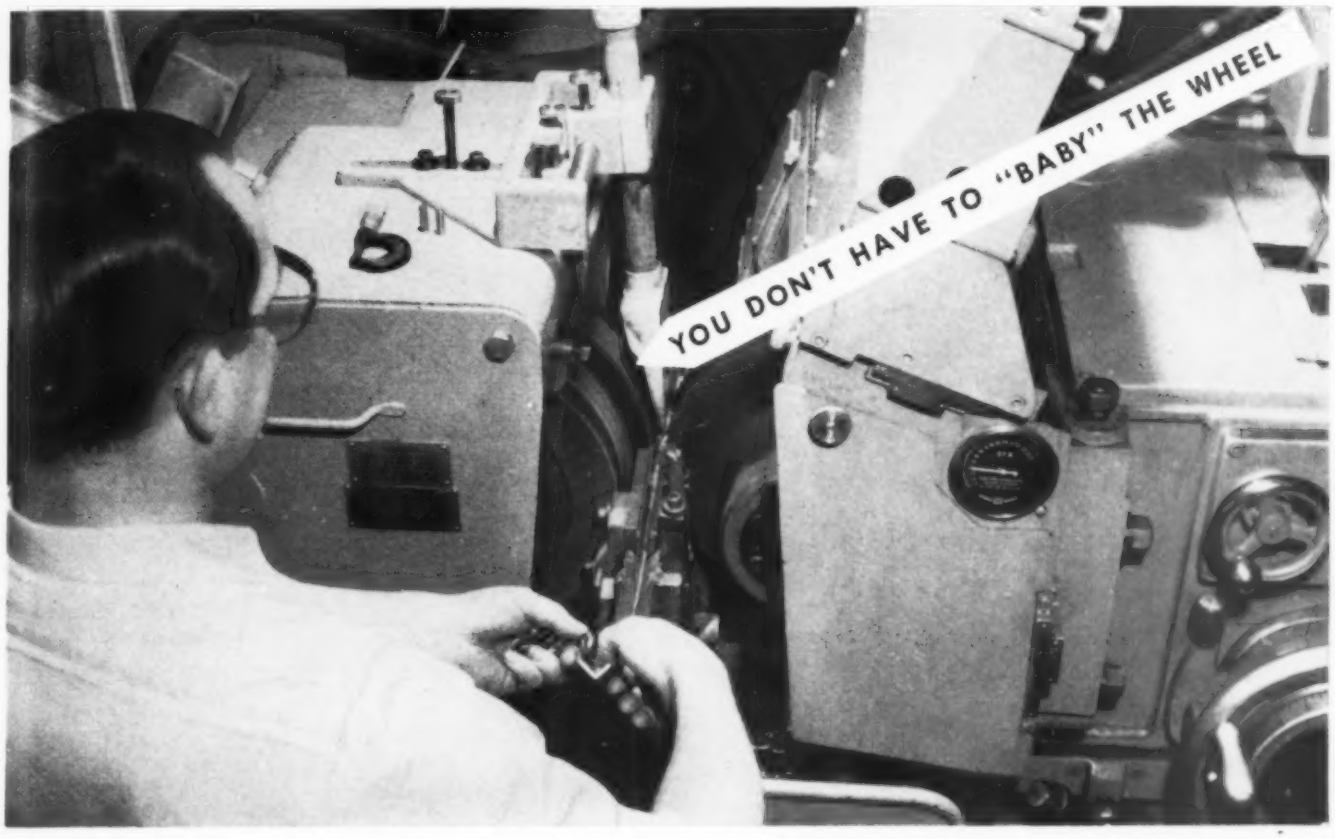


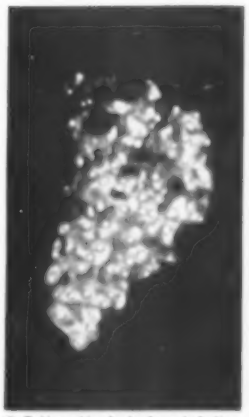
RVG diamonds—with optimized crystals—have built-in qualities that make them superior in wheels for all resinoid and vitrified grinding.

If yours is a heavy-duty grinding operation, wheels containing G-E Man-Made diamonds can take the punishment – and then some! Here's why:

General Electric has improved the crystal characteristics of its Man-Made industrial diamonds for resinoid and vitrified grinding (designated as type RVG). Manufactured under controlled conditions, G-E Man-Made diamonds are of optimum friability and shape to cover wider applications – everything from machining single-point tooling to grinding carbide-and-steel mixtures (even up to high ratios of 50-50!).

And because G-E Man-Made diamonds are irregular blocky crystals with rough surfaces, they stay bonded longer . . . so, you get more mileage per wheel. Wheels containing General Electric Man-Made industrial diamonds are available in ample supply to meet your needs.

Have you looked into the advantages of grinding wheels containing General Electric Man-Made diamonds lately? Better talk it over with your grinding wheel supplier today. *Metallurgical Products Department of General Electric Company, 11177 E. 8 Mile Road, Detroit 32, Michigan.*



G-E Man-Made industrial diamond (enlarged approximately 140 times) with optimized crystal characteristics can be used in wheels for every resinoid and vitrified grinding operation.

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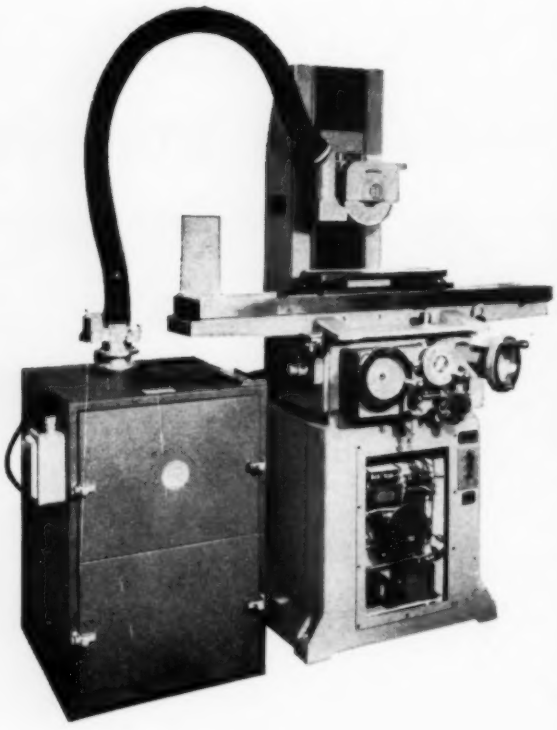
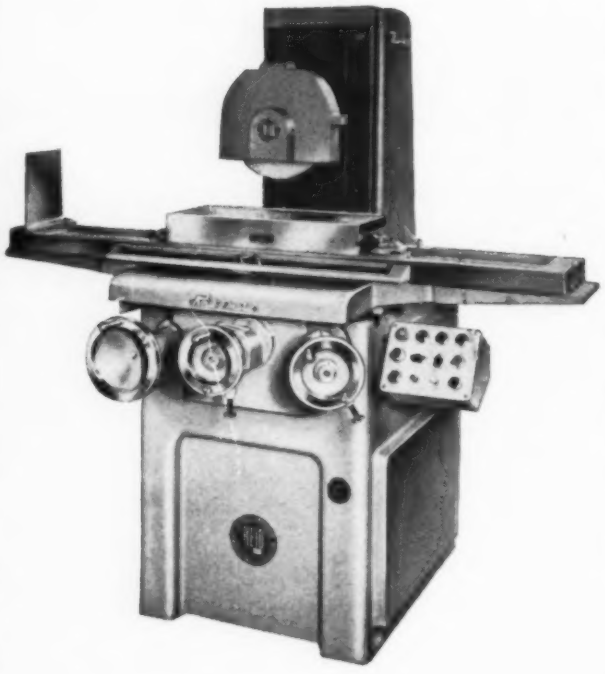


MODEL 618 P
with dust collector



REID-O-MATIC 824 . . .
fully automatic

Industry's number one choice . . . for toolroom and production economy!

The vast number of REID *precision* surface grinders, in all kinds of industry, is the best proof of their outstanding quality.

In the 618 class these different models are available; a 618 P with power operated table and cross feed — a 618 PT with power table and hand operated cross feed — and a completely manual grinder, the 618 H. Automatic lubrication and a Cross Slide Lock are included on REID grinders as standard equipment.

The REID-O-MATIC is a fully automatic, all electric, surface grinder with a capacity 8″ wide, 24″ long and 21″ from the table to the center of the spindle.

For your production and toolroom grinding, REID surface grinders offer the maximum in convenience, quality and economy.

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Complete specifications will be sent on request.

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- heavy cuts
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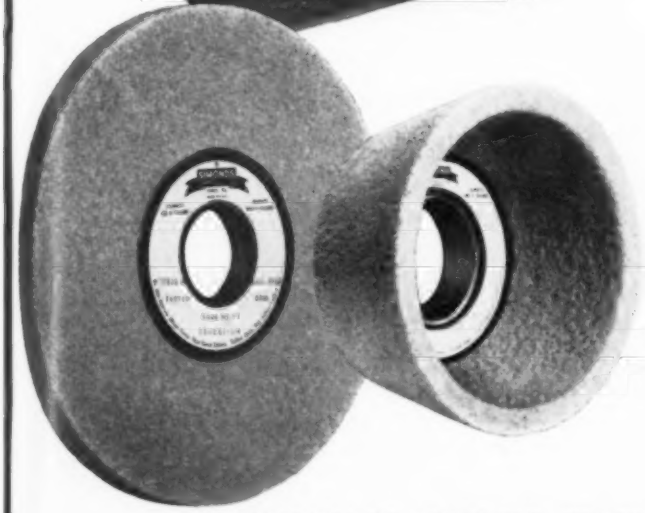

For sharpening milling cutters, broaches, hobs, drills, reamers, etc., or surface grinding hard tool and die steels and special alloys, these wheels are second to none. And here's why. Each particle of SA Borolon aluminum oxide abrasive is a single, natural crystal. That means there are *more* cutting edges on the wheel face for fast, non-burning action and deeper penetration into the work. Also, being more friable, this unique abrasive fractures readily to increase its self-sharpening function, thus minimizing dressing and prolonging wheel life. Order SA Borolon Wheels from your Simonds distributor.

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Machining burrs removed in 4 minutes, with No. 4 abrasive, 240 per hour.

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A Modern Abrasive must team with Modern Equipment to meet the demands of Modern Metal Finishing

One, two, four, eight and sixteen spindle machines are now available in the Rotomatic series. After a part is attached to a spindle, it is rotated in Exolon abrasives, usually in the #4 to #14 size range, which have been conditioned by special compounds to form an abrasive slurry. The spindle indexes through the abrasive slurry returning to the operator's station.

EXOLON abrasives are produced from solid fused aluminum oxide made under carefully controlled conditions in electric arc furnaces. This hard, tough abrasive is carefully shaped and sized and provides speedy uniform finishing results.

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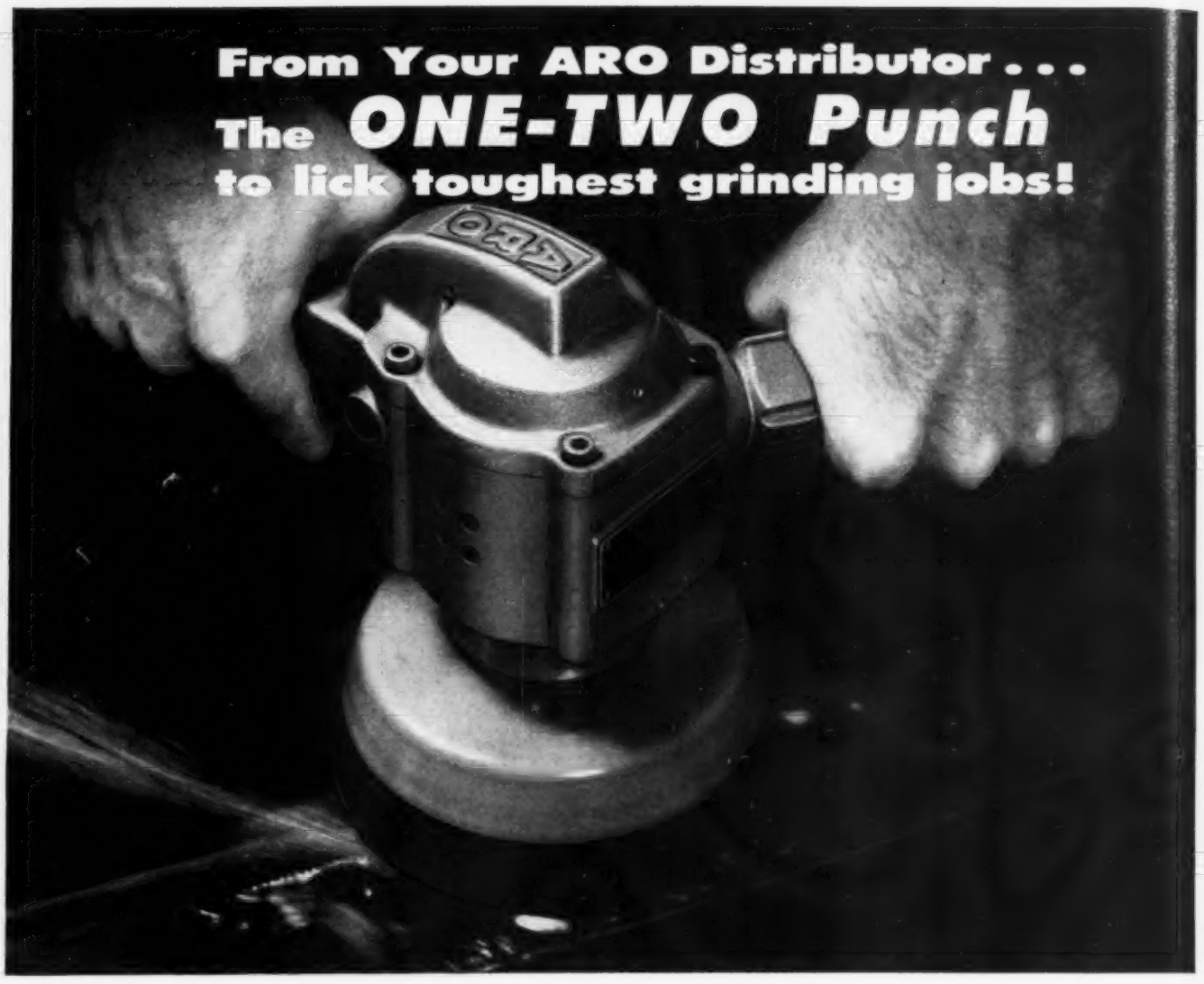

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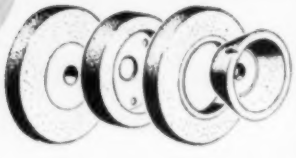

See your ARO Distributor for expert help in choosing the correct wheel for each grinding job. He has a complete selection of standard cup wheels, depressed-center wheels and sanding discs to give you peak efficiency with the new ARO 8300 grinders. Call him today!

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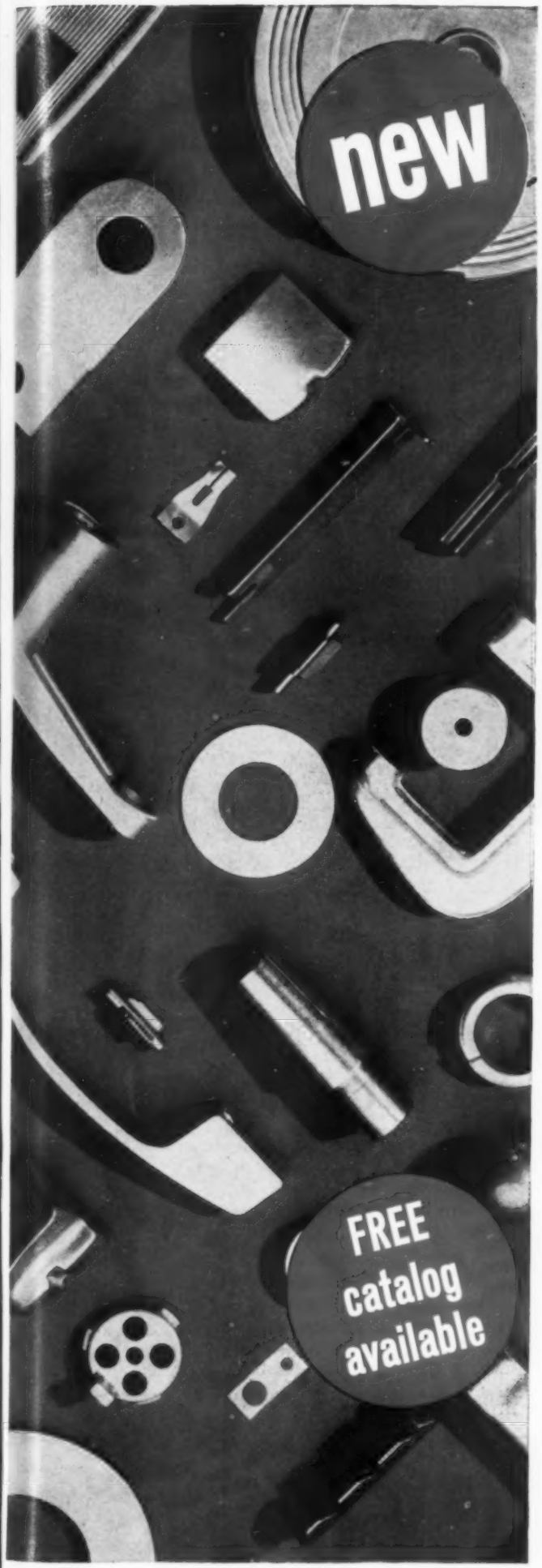

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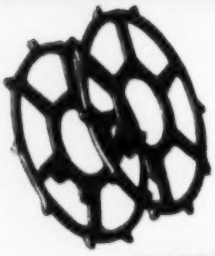

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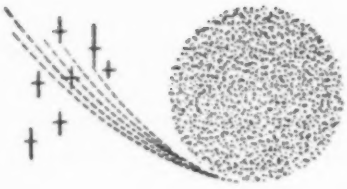
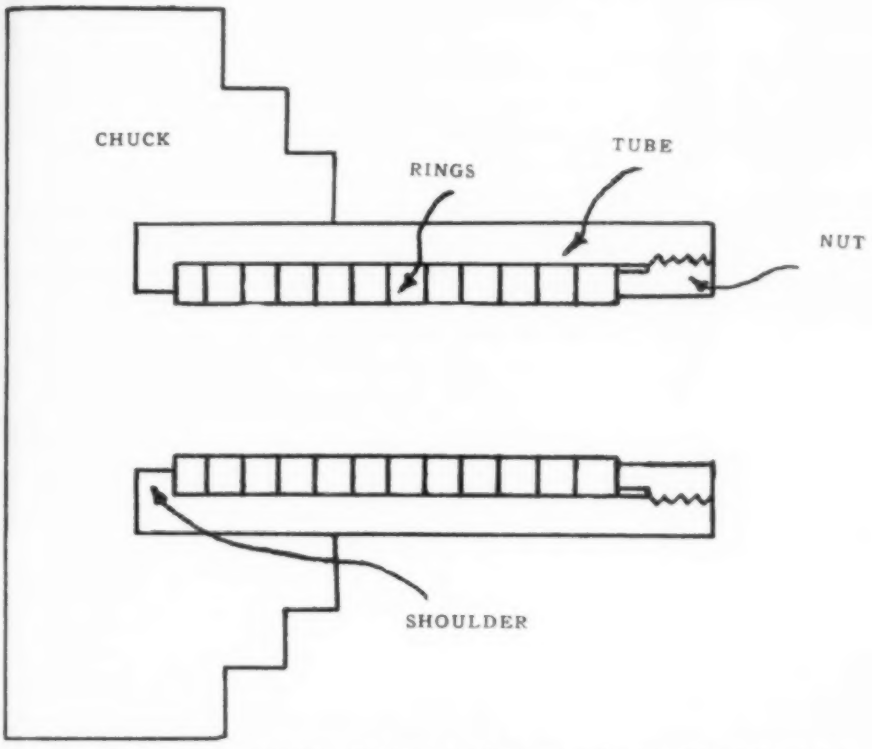


Ideas from the Shop



Sketch of fixture used to hold split rings for internal grinding. The I.D. of the shoulder and the nut must be larger than that of the rings, so that rings can be ground without interference from either. The fixture for external grinding of the rings is similar in principle. The rings are slipped onto a mandrel, and held against a shoulder with a nut.

Grinding Split Rings

By John M. Breen

● Split rings often need to be ground to finish tolerances on the OD and ID. These operations can be quickly and economically done by means of two fixtures, one of which is illustrated.

After the rings have been cut from a coil of suitable stock and flattened to remove the helical pitch acquired in the coiling, they are placed about twelve at a time into a coil bored to a snug fit.

A slight shoulder acts as a stop at the far end of the fixture, and a threaded nut holds the rings at the other end. The ID of the shoulder and the nut must be slightly larger than that of the rings, and sufficient clearance must be provided at the far end of the fixture so that the grinding wheel can reach all of the rings.

For the OD grinding the rings are placed on a mandrel and fastened against a shoulder with a nut.

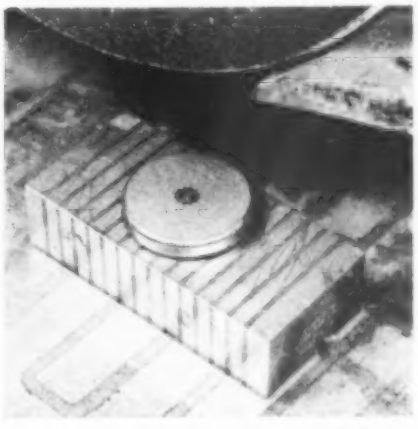
Such fixtures will grind split rings to normal tolerances with high quality concentricity and accuracy.

Laminated Parallel Holds Small Work Better

By H. J. Gerber

● We have found that small size workpieces frequently slip when held directly on the conventional magnetic chuck which has widely separated pole spacings. If the work is seated on a laminated parallel, of the kind often used to block up work on a magnetic chuck, the holding power will be much greater. This is apparently due to the close spacing of the separators which act as numerous flux dams to direct a greater number of separate magnetic fields to the work.

This method has become standard practice in our shop for the grinding of small gages, small thin work and similar parts. • • •



Laminated parallel on conventional magnetic chuck securely holds small workpieces.

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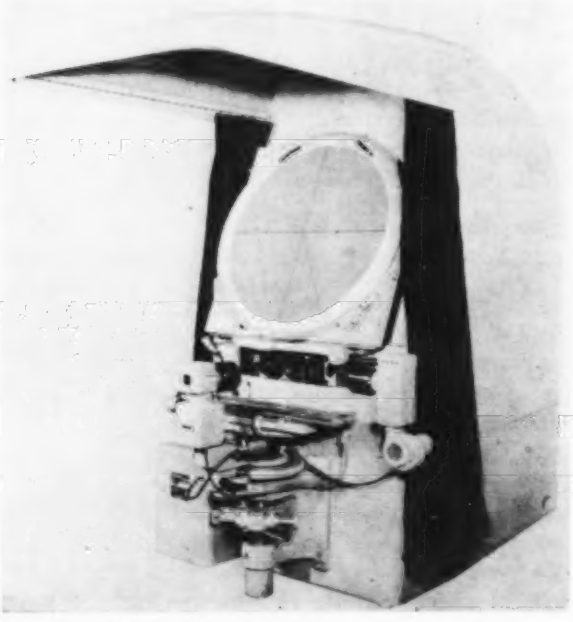
This is what Jones & Lamson is offering in their new Profitivity Lease Plan.® The plan was announced by Holmes H. Whitmore, Executive Vice President, to enable metal working companies to realize a profit from increased productivity with no initial capital outlay and to help the metal working industry replace obsolete equipment and expand production facilities.

The plan requires no security deposit or down payment. The only outlay is for the monthly payments which start 30 days after the machine is shipped. The lease is financed on low bank rates which are approximately $20.50 per month per $1000 value of equipment. With rates this low and no initial expense capital can be used



Jones & Lamson FC-30 optical comparator can be leased with no money down at $246 per month.

for other purposes such as raw material, labor, building facilities, research and development. Manufacturers will also be able to acquire more efficient high-speed equipment.

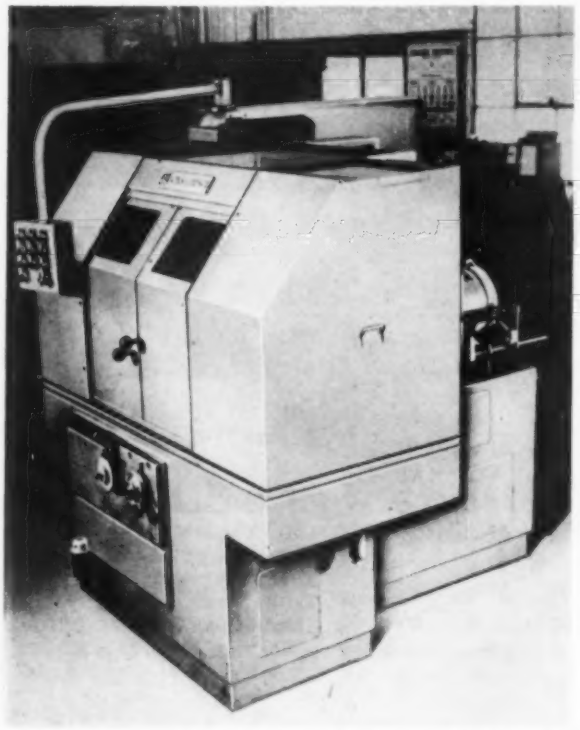
Products and production methods are causing equipment to become obsolete more quickly than in the past. A six month study just completed by Jones & Lamson shows that 45% of all machine tools used by the metal working industry were installed at least fifteen years ago. Replacement of these machine tools would amount to approximately $5 billion.

The normal period of leasing will be five years during which the manufacturer's guarantee period applies, and lessee is responsible for maintenance and repair of equipment. He will have no obligations involving ownership risks other than insurance coverage.

When a five-year lease period is completed, lessee may turn back the equipment with no further obligation, or, he may continue the lease at one-third of the original monthly rate.

The Jones & Lamson Lease Plan has been most carefully designed to enable the lessee to take full advantage of the provisions of the U.S. Internal Revenue Code relating to the taxation of businesses.

The lease may include in a "package" any equipment required to complete the modernization of a production line along with Jones & Lamson machines. The lease may also include expendable items and special tools required for Jones & Lamson equipment. • • •



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Consumers demand refrigerators that will last forever, never require maintenance. Problems solved by Whirlpool on one small part demonstrate how this can be achieved.

Brown & Sharpe surface grinders are set up in this brightly lighted, air conditioned room for precision grinding the length of rotor vanes just before they are selectively matched to rotors.

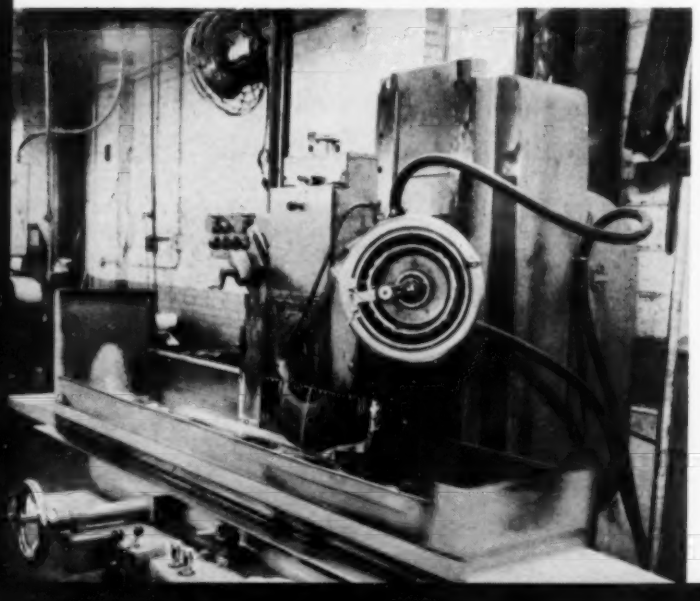
Grinding for MAXIMUM LIFE, minimum maintenance

By DARRELL WARD
Engineering Editor

● The refrigeration industry seems to be far ahead of much of American industry with respect to reliability and service life. A consumer buys a refrigerator, for instance, and expects it to run trouble-free for 15 or 20 years or more. Yet he will pay ten times the price for an automobile and be willing to trade for a new one in two or three years.

Since refrigerator makers cannot view their market as do automobile manufacturers, problems of precision fitting of parts and infinite service life without maintenance must be met and solved. They cannot be passed over as "normal depreciation." Take the insignificant-looking little rotor vanes in the Whirlpool compressor unit for example.

This Gallmeyer-Livingston grinder was chosen for finish grinding the wear surface radius on rotor vane stock because the size and length of stroke produced greater uniformity than a small machine.



The Whirlpool compressor is a rotary type with the rotor head center eccentric to the cylinder. Two vanes slide freely in and out by centrifugal force from slots in the turning rotor head, and sweep against the inside wall of the cylinder. The vanes must be made of material which can perform over an extended period of life without significant wear, and must be selectively fitted to the slots. Selective fitting is required so that each vane will slide freely, but not allow escape of refrigerant or lubricant. To satisfy the average consumer, they must work like this forever.

It's not easy. But in trying to do it, Whirlpool has licked some challenging problems.

Material for the rotor vanes is a fine grain cast semi-steel. Rough stock is purchased oversize in order to reach the fine and dense core of material after machining. It is a matter of going deeper to reach "tight grain" while "loose grain" near the surface is wasted.

The cast vane stock comes in 12" bars which are not cut into the small parts until the last grinding operations are about to be performed. A Mattison double disc thru feed grinder is used to bring the

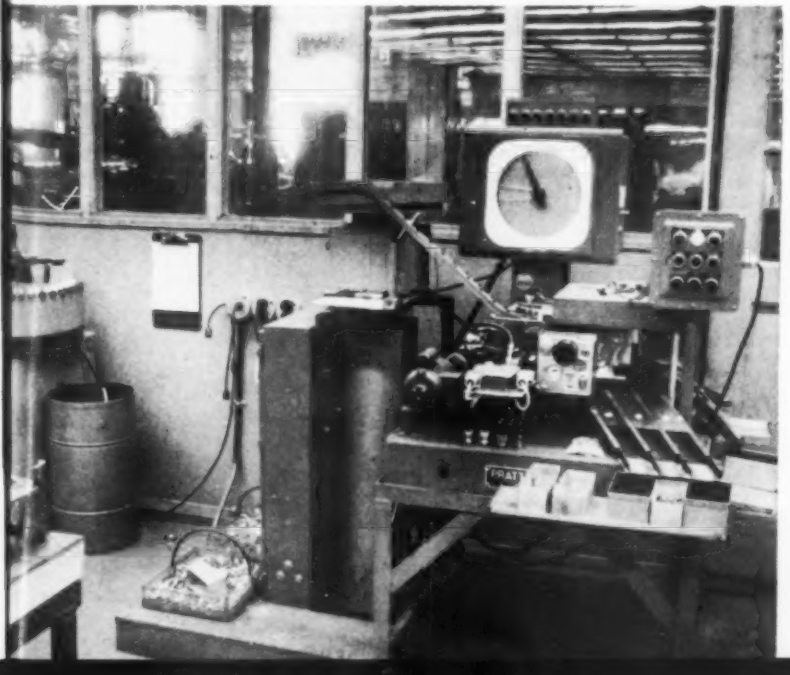
bar stock to desired thickness in the first operation. Approximately .125″ is removed for sizing. Edges are squared and made parallel on a 18″ rotary surface Blanchard grinder. One edge then is milled to a wedge-shaped profile with a radius formed on the sharp corner to match the broached bottom of the rotor slot in which the vanes are fitted.

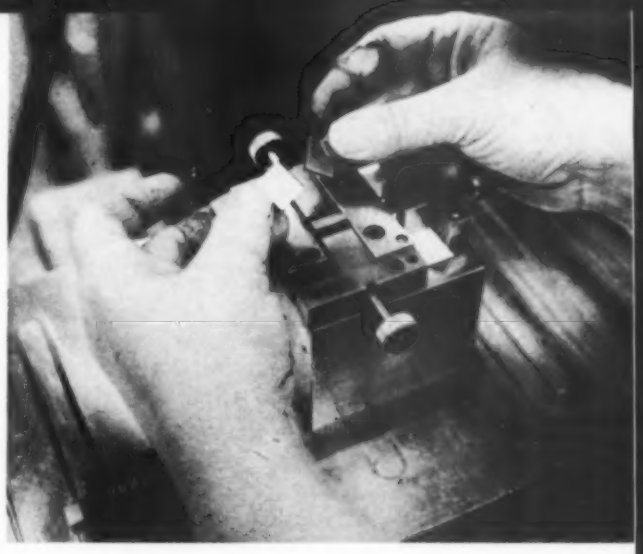
Finish grinding of the flat sides is done on a Heald 261 with sleeve spindle. A Gallmeyer-Livingston 55 does the profile grinding of the rounded outside edge, the wear surface that rides against the inside cylinder wall. This rather large machine was chosen for the relatively small part to utilize the heavy bed and long stroke, gaining better uniformity throughout the length of the part than could be obtained on a smaller grinder. The rounded edge being ground is only ⅛″ thick and is form-ground to a radius of 0.375″ to 0.390″.

At first, the radius was dressed in the wheel with a table dresser. This was satisfactory, except that the operator had to relocate the wheel to the work after each dressing. When the present machine was purchased, it was ordered with a wheel guard dresser installed. This retained constant location of the radius being dressed in the wheel and shifting of the radius in relation to the work does not take place. After that, the clamping fixture which holds the work was permanently mounted on the grinder table. Then, the work piece and the wheel form automatically became aligned without any table adjustment after each wheel dressing. The change in method saved eight hours per week on that one operation.

As an added precaution, all cross feed adjustment controls were removed from the machine. This eliminated the radius location problem, but the periphery of the wheel also required dressing so another wheel guard straight dresser was installed by the tool room.

Machine at far left sorts rotor vanes to thickness in increments of the nearest 0.0001″. Pratt & Whitney gaging equipment at right sorts any batch of a given thickness to different increments of a nominal length.





The clamping fixtures used on the Brown & Sharpe grinders are precision tools with carbide-insert locating surfaces ground and lapped by expert tool makers. Precision here eliminates the need for greater precision during the making of rotor heads.

Now, location and form were satisfactory, but the finish was poor. Different wheels were tested until it was determined that the most satisfactory was a vitrified silicon carbide of 60 grit and K hardness. But, the wheel still did not quite maintain the desired finish of 15 rms or finer. It ranged from 13 to 17 rms. Other wheels showed even greater variations.

The answer came in the form of a small ballas diamond dresser, less than 1/16″ dia. Because of the crush dressing action of the ballas diamond, the operator now can dress his wheel to produce a finish of 10 rms or better. This would not be possible with a worn diamond point because the latter would leave fine lines on the wheel face from its corners or shoulders.

The vane bar stock is clamped in a multiple milling fixture for cutting into segments for different compressor rotors. Lengths range from 9/16″ to ⅞″ nominal size. The resulting small vanes are deburred by barrel tumbling.

Finish grinding must be done in a brightly lighted air-conditioned room where the vanes are also sorted and individually fitted to rotor slots. The vane end faces must be ground within a tolerance of less than .0002″ for squareness and parallelism combined. Grinding to these specifications is done on a Brown & Sharpe No. 5 surface grinder with sleeve spindle, using a vitrified aluminum oxide, 120 grit, L hardness wheel, 10″ x ¾″ x 3″. About 150 parts are ground per hour and the wheel is dressed once every two hours.

The clamping fixture for the finish grinding is made from a block of aged steel, milled and ground almost with the precision of gage blocks. Each locating surface consists of carbide inserts, ground and lapped. The importance of developing such

an accurate clamping fixture is emphasized by the fact that management requires that at least two toolmakers, if not three, be thoroughly familiar with the construction, maintenance and resetting of these clamping fixtures.

Stock removal in the finish grinding amounts to as much as 0.005″ to 0.010″, depending upon the condition of the vanes when they are rough cut. The squared ends are brought to 15 rms finish in this dry grind.

Length varies according to demand from assembly where vanes are selectively fitted to the rotors. Air gages are used for checking length. Normal tolerance permits 0.0002″ over or under. If the selective fitting results in a shortage of certain lengths, the grinding machine operators will get orders for parts slightly larger or smaller, within a given tolerance, according to size demands of the moment. These are established by thickness of rotor heads.

At one time, there were four girls who checked and sorted for thickness to length. Then, another 6 to 8 girls checked and sorted to length from batches of a given thickness. The shop developed a machine which now separates vanes according to thickness. An indexing head rotates and drops parts into different bins, sorting vanes to the nearest 0.0001″.

A bin of uniformly thick vanes then is loaded into the Syntron hopper feed of another machine where Pratt & Whitney gaging equipment sorts to length and charts each batch run.

The precision with which the rotor vanes are produced for Whirlpool compressor units allows for very economical abrasive cutting of the slots in the rotor heads (GRINDING and FINISHING, May, 1958). By plunge cutting the slots with a worn wheel, the company eliminated a number of other machine operations and the accompanying tool and maintenance costs. And, the economy of producing rotor head slots more than offsets the precision required for vane grinding.

In addition to that, since vanes must be selectively fitted to slots anyway, it has been found profitable to utilize the precision control of the smaller parts to shift sizes as required to mate with the variations in size of the rotors. The resulting fit between any acceptable size rotor and its matching vanes is less than 0.0002″, an adequate tolerance for free running parts which do not permit escapement of refrigerant or lubricant.

Thus, Whirlpool has, by design specifications, attempted to give the customer a unit which comes as close as any mechanical device to infinite service with no breakdown nor maintenance. • • •

The Care And Use Of Diamond Tools

1. A diamond tool should be held securely in a rigid holder to prevent vibration. Vibration will very often result in shattering the diamond.

2. The tool post holding the diamond tool should be inspected from time to time to see that it is rigid. Run a tap through the set screw holes in the diamond tool holder occasionally to make certain the set screws turn freely and grip the diamond tool securely.

3. The diamond should be brought into contact with the wheel at a slight angle just below the center line of the grinding wheel (5°—7°), so that there is a slight drag on the stone. Never make contact above the center of the wheel. This will cause severe vibration.

4. When starting to dress the grinding wheel, the diamond should be brought up to the highest point on the face of the wheel until contact is barely made and then traversed fully across the wheel in both directions. The diamond should never be brought in from the side on the first pass. If the operator takes too heavy a cut it will damage the diamond severely.

5. After the first pass the diamond should be fed in .001″ for each successive complete pass in both directions. Too heavy a cut may result in excessive wear or damage to the diamond.

6. Wet dressing is not absolutely necessary but often desirable. It is important, however, to avoid intermittent heating and cooling of the diamond. When dressing wet, maintain a constant flow of coolant in order to avoid injury to the diamond.

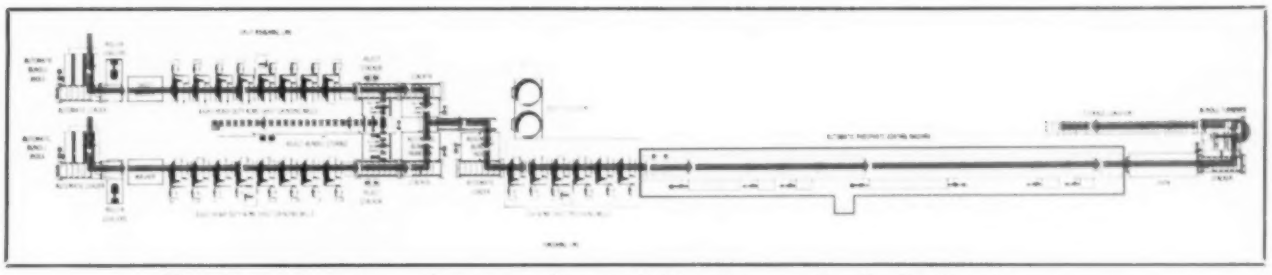
7. Never dress a grinding wheel on a cold machine. Make sure the machine has been running long enough to warm the bearings. Check the bearings from time to time to see that the spindle is rigid. Any play or lash in the spindle can be destructive to the diamond.

8. When the diamond is worn down to the metal of the holder it is time for resetting. An excess of sparks means the holder is being ground away which will ultimately loosen the diamond. Wheel marks on the holder indicate improper use of diamond tools.

9. Never grip a diamond tool at the diamond end, in a vise, or apply other severe pressure, in order to extract the tool from the tool holder. Considerable damage may result if lateral pressure is applied. If the tool cannot be freely extracted from the holder, provision should be made to drive it out from the back.

10. DIAMOND IS THE WORLD'S HARDEST MATERIAL. However, because of this property, diamond is brittle. It does not require a very hard blow to damage a diamond. It may be fractured or broken by striking any hard substance such as the bed of a machine or concrete floor.

(Courtesy New York Diamond Tool Co., Inc.)



The floor plan shows the Acme sheet polishing line at the Ford plant in Monroe, Michigan. The color indicates the direction of flow of the steel sheets.

Two Rough for One Finish at Ford

Full automation of the steel sheet polishing operation at Ford's Monroe plant required two parallel roughing lines to feed one finish line. The roughing lines can be slowed to obtain the required stock removal while the finishing line works at maximum efficiency.

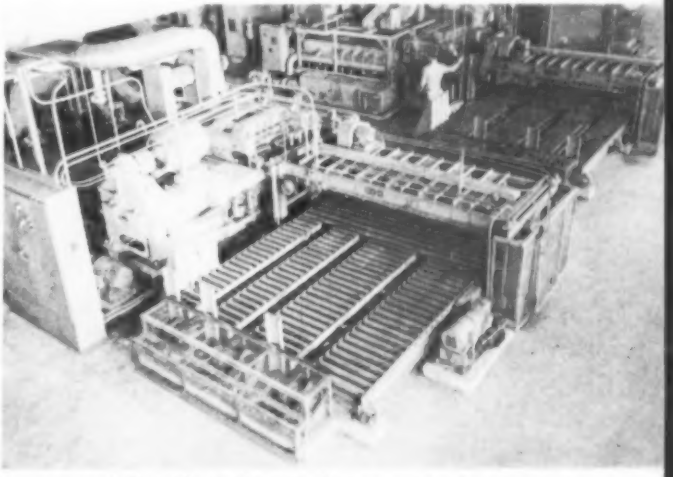
Special to **GRINDING** and **FINISHING**

● The new 343-ft long fully-automated line for polishing high quality steel sheets for automotive bumper stampings at Ford Motor Company's Monroe, Michigan, plant represents the solution of a complex problem. It was one of meeting conditions of high production rates and low operating cost for a nominal investment in capital expenditure and floor space. The solution, worked out jointly by Ford process engineers and Acme Manufacturing Co. engineers, is a unique set-up that combines two roughing lines to feed one finishing line.

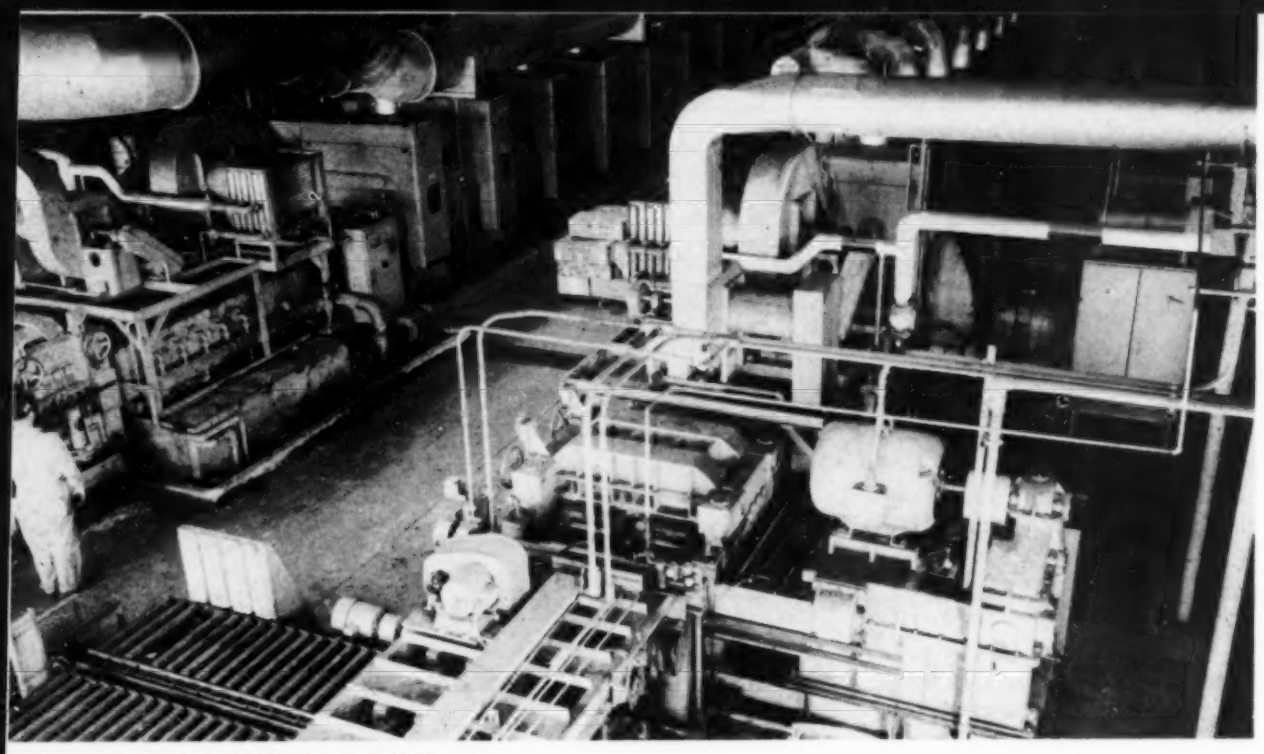
A complex automation system was developed and installed to reduce the downtime normally encountered in bundle transfer of sheets. Downtime for sheet width changes has been reduced to a simple process of changing polishing belts, and worn belts are replaced without line stoppage. The usual manner of using electric eyes at each sheet edge to provide a centerline type of control requires moving a set of electric eyes on every unit in a line when sheet width is changed. This new line has a single electric eye control on each unit for the front edge of the sheet only. This means that no eye adjustments are necessary when sheet widths change.

The split-line roughing concept enables the roughing lines to be slowed to effect a stock removal of up to four per cent of gauge thickness. This results in a high yield of acceptable polished sheets and a minimum number of rejects. Elimination of extra equipment and a high degree of automation are other factors that give a high yield with minimum total cost.

Acme Manufacturing Company of Detroit acted as the prime contractor in engineering, building and installing the equipment. L. W. Nash Company built the automation system and C. A. Dauer constructed the coating line. Because of the high production of the line, special consideration had to be given to ruggedness. As a result, steel mill



Automated bundle index and automatic loaders at the front of each roughing line.

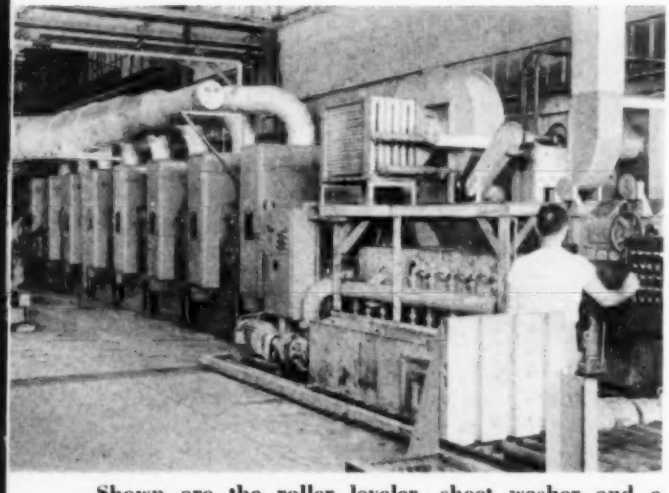


Over-all view of the Acme polishing line.

type equipment was used throughout. The system includes coding devices that identify each sheet by month, day, shift, and vendor. The automatic system controls bundle sizes to accurate piece count.

Bundled flat steel sheets are indexed to Nash automatic loaders and through McKay roller levelers and sheet washers in front of each of the two roughing lines. At the end of each roughing line are reject stackers. An inspector at this point determines whether the sheet has a satisfactory surface to finish. If satisfactory, the sheet is fed into a prime stacker. If it is unsatisfactory, the sheet drops to a reject stack. From this reject stack, bundles of sheets are transferred automatically to a storage conveyor where they await crane transfer back to the bundle index of one of the roughing lines.

Satisfactory rough finished sheets are stacked into piece-counted bundles and transferred to an automatic loader in front of the finishing line.



Shown are the roller leveler, sheet washer and a section of one of the eight-unit Acme roughing lines.

After the sheets pass through the finishing mills, they pass through a Dauer two stage brush washer automatic phosphate and soap-coating machine, an oven and into another stacker. The stacks of finish polished sheets are turned over and moved onto a storage conveyor so that the sheets are in the finish-side-down position for the subsequent pressforming operations.

The roughing mills are made up in split parallel lines each having eight Acme Heavy-duty 40-in. polishing machines of massive construction. Each of these abrasive belt finishing mills is powered by a 75-hp motor and can remove up to 0.004-in. of stock per unit. This is the equivalent of 3-hp per in. of belt width, which permits relatively high stock removal.

The finishing line is made up of six Acme 40-in. sheet polishing mills. Each of these units is powered with a 50-hp motor for an equivalent of 2-hp per in. of belt width.

Each of the Acme polishing mills has four operating components: An idler roll, a contact roll, a billy roll, and two sets of four pinch rolls. The abrasive belt is supported by the contact and idler rolls. It is driven by the main drive motor through a V-belt drive to the main spindle that mounts the contact roll. An air cylinder raises and lowers the idler roll assembly to maintain belt tension. Oscillation and tracking of the belt is achieved by pivoting the idler roll yoke with an air cylinder controlled by an externally-mounted electric eye arrangement.

The flat sheets are traversed through the mill between contact and billy roll by pinch roll assemblies that are ahead of and behind the contact roll. The pinch rolls are driven by a separate motor through worm gear transmissions and flexible couplings. The billy roll provides

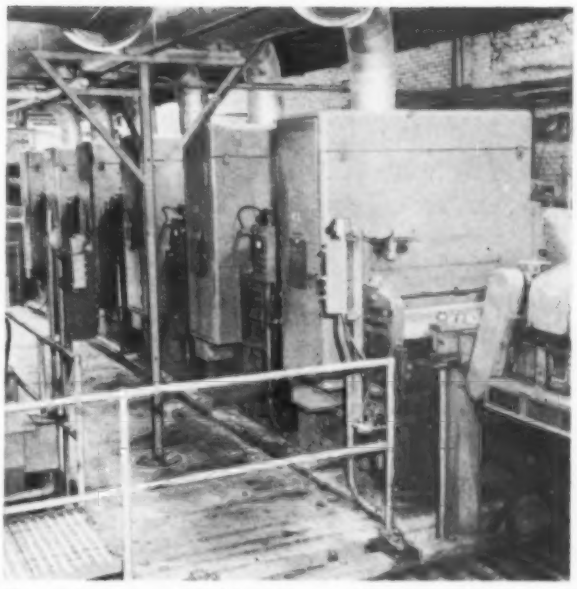
the work pressure and is adjusted by air cylinder to provide the desired pressure. Push-button and valve controls for operating each Acme mill are in a panel at the spindle housing end.

In designing the finishing line, Acme engineers had to consider many factors in order to assure that full automation could be effectively and efficiently carried out. Personnel required to operate the entire line includes two roughing line operators, two inspectors, one finish line operator, a floor level crane hooker at the loader and unloader, and a laboratory attendant for the coating machine processing solutions.

Several unusual automation features are included in the line. The finishing line runs at approximately 20% greater speed than the roughing lines so that a continuous flow of sheets is made to the finishing line without causing excessive buildup of prime sheets at the load end. The automated transfer of bundles has no effect on the operation of the line.

At the front of each of the roughing lines three bundles of flat sheets are placed on a bundle index by a crane loading operation. A bundle is automatically indexed into the automatic loader in front of the roller leveller as soon as the loader is empty. At the end of each roughing line, reject sheets drop onto a transfer car. When the proper number of sheets is stacked, the transfer car automatically moves into position and unloads the bundles onto the reject storage conveyor. One transfer car cannot move unless the other is in the stacking position.

Prime stacks of rough finished stock that pass inspection are lined up on an indexing conveyor, one for each roughing line. Demand by the automatic loader in front of the finishing line causes a prime stack to advance into loading position. Index conveyor movement is controlled by the transfer car. If a full load, prime stack condition is encountered, both roughing lines shut down automatically. When a line shuts down, the billy roll in each Acme mill drops automatically and thus prevents damage to sheets in process.



Six unit Acme finishing line and automatic loader.

Any breakdown in part of the polishing line automatically shuts down all operations behind the shutdown. If two sheets, or an oversized sheet, feed into a roller leveller, the sheet reverse-feeds automatically and the line shuts down. A trouble-shooting panel made in the form of a miniature copy of the line has indicator lights that indicate trouble source areas in the event of breakdown.

In order for the line to operate with a minimum of dust and dirt in the atmosphere surrounding it, an extensive Centri-Spray air scrubbing system was installed. Four 25,000 cfm units on a single base handle the roughing lines. Two 15,000-cfm units on a single base remove dirt and dust from the finishing line units. • • •

Centrifugal Separator Ups Diamond Wheel Life

● By removing ground glass from grinding coolant with a centrifugal separator, a jalousie window maker has increased diamond grinding wheel life over 50% and eliminated a day per month of grinding machine downtime.

These are the results reported since Alsco, Inc., maker of jalousie doors and windows as well as aluminum siding, storm doors and windows, installed a De Laval Model 115 coolant clarifier in its Clifton, N. J., plant six months ago.

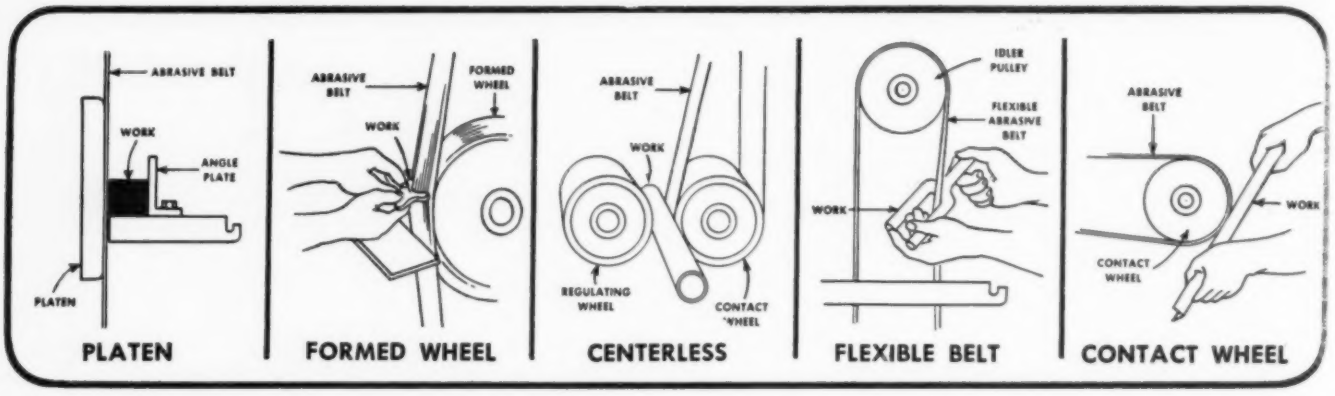
The coolant clarifier is installed in the coolant recirculation line of the glass grinding machine. This machine incorporates six $500 diamond edged grinding wheels, three in series for each side of the rectangular jalousie slats. Slats fed through the machine receive a rough grind and two finish polishes to produce a smooth contoured edge.

Ground glass from the grinding operation is washed into the coolant and carried to the centrifugal clarifier. The glass-laden coolant flows into the top of the centrifuge and into the center of the whirling bowl. Centrifugal force, produced by the bowl's 1500 rpm rotation, spins the coolant and glass to the bowl wall. The glass accumulates on the wall while the coolant is displaced upward to flow over the wall for recirculation.

Previously, a single set of diamond wheels ground four-million inches of glass slats before requiring redressing and eight million inches before scrapping. Now, these figures have increased to about six or seven million inches before redressing and proportionately more before scrapping. Daily production is about 100,000 inches of glass and the increased wheel life will save one set of $3000 grinding wheels each year.

Another plus value of the clarifier is the sharp drop in downtime for cleaning. This formerly took a half-day every two weeks. It now requires only a few minutes, periodically, to change to the spare centrifugal bowl. • • •

BELT GRINDING: opportunity unlimited for faster finishing and metal removal

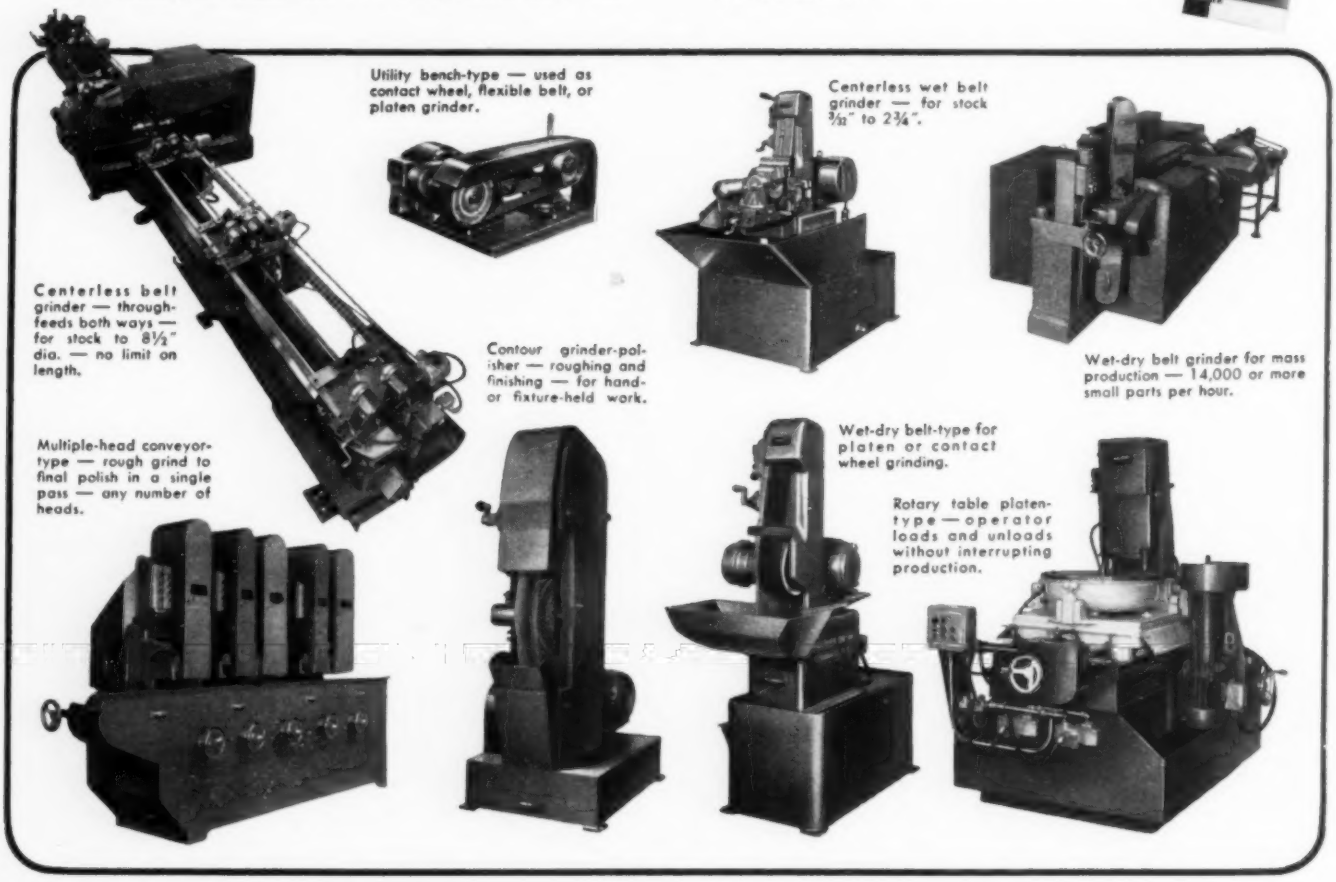


The opportunities for application of Sundstrand Engelberg precision abrasive belt grinders to improve quantity and quality of work are a stimulus to the imagination of creative methods men.

The belt grinding principle provides exceptionally rapid stock removal — up to three pounds of non-ferrous metal per minute! It speeds production and reduces costs because on most jobs it's from two to eight times faster. Setups are simple . . . tool dressing or grinding is eliminated . . . change-over takes but a few minutes . . . fixturing is simpler . . . and surface finish normally is markedly improved.

Wet and dry belt types are available for every requirement from toolroom work to automatic production of as high as 15,000 parts or more per hour.

A few of the many models of Sundstrand-Engelberg grinders are illustrated below. For more complete information, ask for descriptive literature.


Utility bench-type — used as contact wheel, flexible belt, or platen grinder.
Centerless wet belt grinder — for stock 3/32" to 2¾".
Centerless belt grinder — through-feeds both ways — for stock to 8½" dia. — no limit on length.
Contour grinder-polisher — roughing and finishing — for hand- or fixture-held work.
Wet-dry belt grinder for mass production — 14,000 or more small parts per hour.
Multiple-head conveyor-type — rough grind to final polish in a single pass — any number of heads.
Wet-dry belt-type for platen or contact wheel grinding.
Rotary table platen-type — operator loads and unloads without interrupting production.

SUNDSTRAND ENGELBERG

SUNDSTRAND MACHINE TOOL

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WHY HONING

Part II

The first part of this series covered the fundamentals and area of application for honing. This part will describe the types of equipment and points of importance of each. Part III will cover tools, abrasives and coolants. Part IV will discuss how to apply, pitfalls, errors and corrections.

Figure 1. Close-up of a Sunnen Products manually-stroked honing machine. Shown here is the precision honing of tandem bores of an instrument bracket.

● There are basically two types of honing machines. They are the power operated and the manually-stroked or hand operated. Each type of machine has its own area of excellence. Manually-stroked machines are very adaptable to honing small parts and to reworking. Power operated machines lend themselves to high production or automation.

Most all manually-stroked machines employ a horizontal spindle design. The operator is required to place the part over the mandrel or tool and provide the reciprocation by stroking the part on the tool. The machine expands the honing stones in the tool and provides the rotation of the tool. Although it may appear to require more operator skill, manually-stroked machines are easily operated and skilled operation very easy to obtain because of the inherent qualities of honing.

Initial costs of manually-stroked honing are a great deal less than those of power operated as the machines are simpler and, of course, do not require fixturing. Still another advantage of this type is the control of the operation by the operator. The operator can instantly change stroke speed, length, stock removal, reverse the part end for end, feel the torque and stone performance, and generally alter the honing operation according to the requirements of the part.

Power operated honing machines fall into two general classifications—the vertical and the horizontal. Both types control the reciprocation and the rotation of the tool during the operation. These machines most often also control the honing stone expansion or pressure, but this can be controlled by an adjusting head mounted between the machine and tool, which will be described later.

The difference between the application of the two types lies in the length of the part. Horizontal machines are for the most part recommended for long parts to facilitate handling and in the case of low ceiling of housing.

There are many successful horizontal honing operations being performed now. However, one company expresses the opinion that, particularly in the case of large bores, the weight of the honing head or tool produces more pressure at the bottom of the bore. This requiring rotation of the part during honing. The results are a series of arcular surfaces that intersect each other instead of a geometrically round bore, according to Fulmer.

Recently, small horizontal machines have been designed which have been successfully applied to short bores. These machines provide reciprocation through a hydraulically actuated carriage.

The general range of horizontal machines is from ½″ to 36″ diameter, and up to 100′ in length. The machines consist of the base (must be more than double the length of the part), the head (motor for rotation, spindle and hone expansion if required) and fixturing.

Vertical honing machines vary in design. Some machines are designed so that the entire head moves over the full length of spindle travel, while others are designed so that only the spindle moves. Vertical machines are also designed with either a standard column, as is provided for drilling machines, or they are designed with several cylindrical columns. Consisting of the head, column and base, still other variations are incorporated into the design.

Most of the heads or spindles are reciprocated hydraulically. Length of the stroke is ordinarily

Figure 3. Barnes Drill Co. Model 10M1, capacity ID ¼" to 1½", length 2½" including mechanical reciprocation, pneumatic hone expansion and automatic compensation for stonewear.

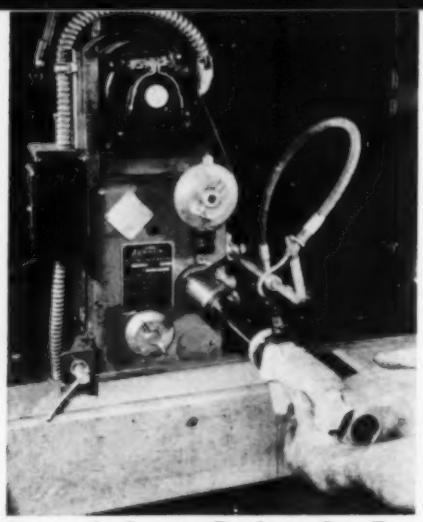


Figure 4. Sunnen Products Co., Precision Honing Machine, manually-stroked with capacity from .370" to 3.300". Shown here machine is being used to hone a hydraulic control housing.

Figure 5. Micromatic Hone Corp., Model 738, with capacity of ¼" to 1" diameter and 3" in length. Machine has mechanical reciprocation and rotation. It can be equipped with automatic hone expansion to provide completely automatic cycle.

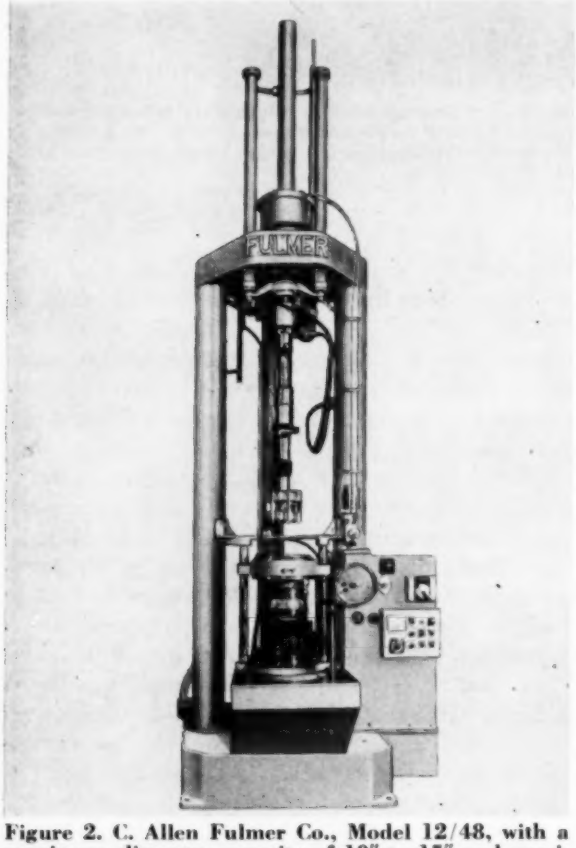


Figure 2. C. Allen Fulmer Co., Model 12/48, with a maximum diameter capacity of 10" to 15" and maximum stroke of 48". This machine is equipped with automatic feed, automatic spindle withdrawal and Fulfeed "timing honing cycle."

controlled by limit switches. The hone expansion is usually located in the head. The expansion may be hydraulic, mechanical, pneumatic or electric.

Bases of vertical honing machines can be similar to a standard drill press base or table type. In and out, or lateral travel type tables, are also available in most cases. These machines are readily adapted to production and can be completely automated. This involves fixturing and sizing, which will be discussed later.

The speeds, feeds and horsepower employed with the honing equipment have a direct bearing upon the efficiency attained with the honing stones. Properly applied, they make possible the extended stone life, closely controlled surface finish, uniform stock removal and consistently satisfactory performance from a single grade stone.

Proper speeds for honing are actually a combination of the rotation and reciprocation of the honing tool. This combination produces the cross-hatch pattern of finish which is so closely associated with honing. Any surface speeds recommended are not intended to be strictly adhered to, but rather represent guides for starting conditions in the setup of a honing operation. The speeds shown below are based on rotation only. The effect of reciprocation, although tangible, is assumed to be reflected in the values of rotational speeds determined experimentally when normal reciprocation is present. After rotational speed has been selected, the reciprocation can be chosen for the desired cross-hatch angle required. This cross-hatch angle is usually between 20° and 40°.

It should be noted that honing differs from peripheral grinding in that it does not require change in speed due to change in diameter of abrasive. The only change in diameter of the surface of the honing tools is the result of change in diameter of the work.

Generally 200 sfpm is the speed at which honing is best conducted. However, to determine more accurately the speeds required, consideration for the type of material, hardness, characteristics of the surface and abrasive area must be observed.

The formula for surface feet per minute is:

$$S = \frac{K \times D}{W \times N}$$

The formula for speed is: $rpm = \frac{R}{W \times N}$

S = Surface feet per minute
K = A factor taken from chart, (below——.)
R = A factor taken from chart, (below——.)
D = Diameter of bore in inches.
W = Width of stones in inches.
N = Number of stones.

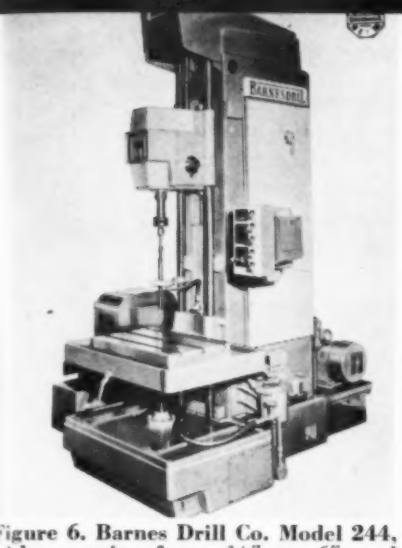


Figure 6. Barnes Drill Co. Model 244, with capacity from ½" to 6" and spindle travel from 15" to 40". Vee belt drive for rotation. Hydraulic reciprocation, sizing and electric, pneumatic or manual hone expansion may be provided with this machine.

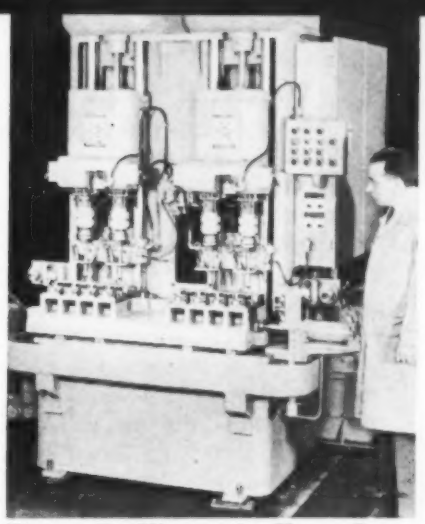


Figure 7. Micromatic Hone Corp., Model 710-4, four spindle machine is a combination of two 710-2 units for increased production. Each head has individual automatic stone feed, stone-wear compensation and automatic size control.

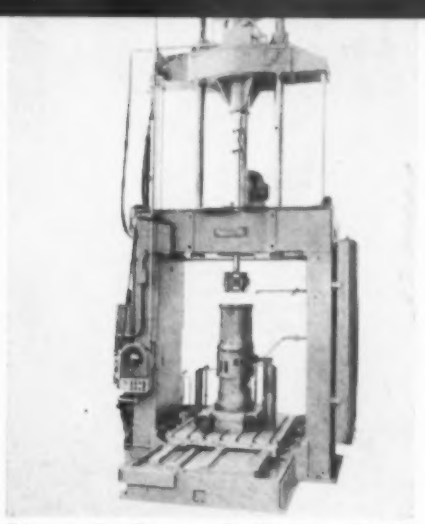


Figure 8. Barnes Drill Co., Model 8530, with capacity of up to 36" diameter and up to 72" length. Pneumatic hone expansion includes rapid expansion and collapse to or from the wall of the work. Also included is a hydraulic in and out table.

Material	Hardness	Character of Surface	K	R
Cast	Soft	Base Metal	110	420
Iron	"	Dressing Surface	150	570
	"	Severe Dressing	200	760
	Medium	Base Metal	80	300
	"	Dressing Surface	110	420
	"	Severe Dressing	150	570
	Hard	Base Metal	60	230
	"	Dressing Surface	80	300
	"	Severe Dressing	110	420
Steel	Soft	Base Metal	80	300
	"	Dressing Surface	110	420
	"	Severe Dressing	150	570
	Medium	Base Metal	60	230
	"	Dressing Surface	80	300
	"	Severe Dressing	110	420
	Hard	Base Metal	50	190
	"	Dressing Surface	60	230
	"	Severe Dressing	80	300

Soft—15 to 45 Rockwell "C"
Medium—45 to 60 Rockwell "C"
Hard—60 to 70 Rockwell "C"

The character of the surface is classified according to its effect on the abrasive.

BASE METAL—Honed, ground or fine bored surface that will have little dressing action on the grit.

If over half the stock is removed after the surface is cleaned up, the speed should be computed using the Base Metal factors for K and R.

DRESSING SURFACE—Rough bored, reamed, broached surface or those broken by cross holes or ports.

SEVERE DRESSING—Surface interrupted by key-ways, undercuts or burrs that dress the stones severely.

NOTES: Judgment will have to be used in applying the formula, for example: Any hardness of from 15 to 45 R.C. is classified as soft. In Cast Iron—Base Metal—the K factor is 110 for Soft and 80 for Medium Hardness. If the surface has a hardness of 35 Rockwell "C" the value of K would be about 90.

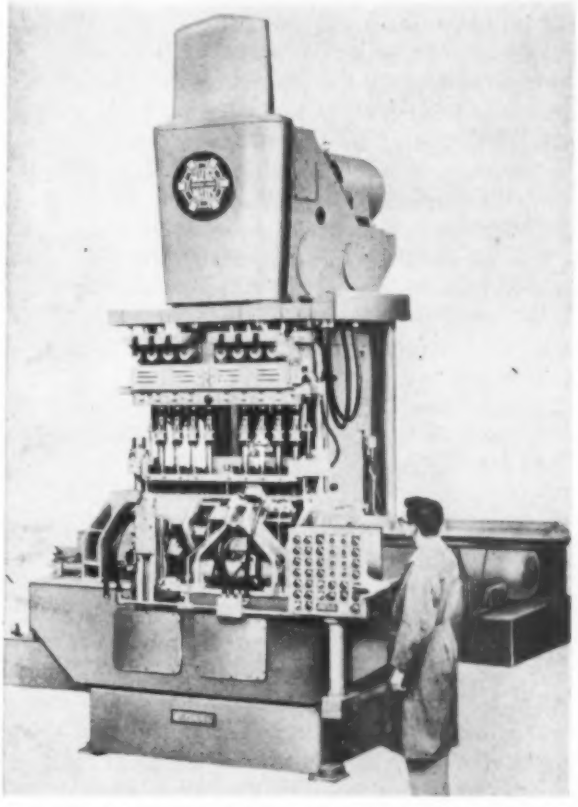


Figure 9. Micromatic Hone Corp., Model 420, capacity of which depends upon the number of spindles being used. Length of stroke is 20" with complete automation. Shown here the machine is equipped with a tip-up fixture for honing V-8 engine blocks.

This is also true in evaluating the character of the surface. There is a range between the classifications and how severe the dressing effect will be must be judged when applying the K factor.

With tools that have several banks of abrasives, N is the number of sticks in one bank.

Since, in many cases, the use of this formula results in higher rotation speeds than those used in the past, it is very important that floating fixtures be kept as light as possible to minimize the effect of erratic fixture motions.

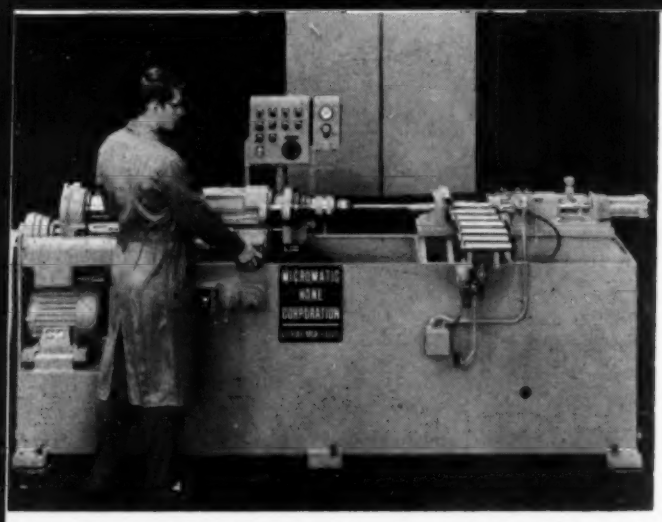


Figure 10. Micromatic Hone Corp., Model 523, single spindle quill type horizontal machine. Maximum stroke is 15". Machine can be designed with double spindle or two opposing spindles.

The speeds obtained from any formula can only be used as a guide. Final speed selection often will be determined by trial.

Rate of feed or stone pressure depends upon many variables. On machines with hand adjusting heads, the feeding of the stones is left to the operator. This type of feed is also a varying type as the stones are forced into the work and then allowed to wear and remove stock for a period of time till the operator again adjusts the position of the stones. Pneumatic, hydraulic, and electric hone expansion are all provided within the machine, while the above-mentioned adjusting head is a mechanism usually mounted between the spindle and tool.

On machines with the automatic types of feeds such as pneumatic, hydraulic and electric, the pressure is constant and results in a consistent rate of feed. These types of expansions also can be designed to rapidly feed to the work and then change to fine feed during contact with the work. The rate of feed or pressure on the stones will depend upon the finish, type of stone, type and hardness of material and rate of stock removal required.

Honing machines are generally equipped with two motors, one for reciprocation and the other for rotation. The horsepower requirement rotation is usually higher than reciprocation due to the torque developed by the tool being tightly expanded in the bore of the work. In general, one horsepower for every inch of bore diameter is considered right for production applications.

Reciprocation is generally accomplished by means of hydraulic cylinders activated by means of a hydraulic pump driven by an electric motor. This motor should be ½ horsepower for each inch of bore diameter with additional power required if hydraulic hone expansion and/or hydraulic fixturing is used.

Fixturing is one of the two most important areas in the honing process. Almost all honing of cylindrical parts can be honed on standard machines. The area of design change for various parts is with the tools and fixtures. In most applications, either the tool or the part must be free enough for the tool to align itself with the neutral axis of the bore. The tool is thus able to float in the bore and exert equal pressure in all directions. One of the honing companies takes exception to this theory and claims better honing results through the use of closely aligned fixtures with rigid tool and fixturing.

Floating the part in the fixture is required when the bore is large in comparison to the length, or in cases of bores of less than ⅝". Honing of these bores with universal action in the tool would result in a whipping action of the drive shaft of the tool and bell mouthing of the bore. The universal action of the floating part must be at the center of the surface being honed regardless of the shape of the part.

For production, fixtures of two parallel plates have been used. This design requires some protrusion on the part to take the torque. Still other designs utilize rotary or lateral table movements. These allow for loading of the part at one station while honing is performed on one or more of the other stations. Sometimes short bores can be stacked and be honed as one long bore.

As in the design of any fixturing, the part must be held without distortion. In honing the part should not be clamped so as to put any pressure on the bore. Clamping end for end with the clamps directly opposed. In all cases clamping must be metal to metal.

For straight bores, all fixturing must provide for the overrun of the tool during reciprocation. The overrun will be approximately 1/3 the length of the stones. Design of the fixturing should also provide for a flood of coolant both in the bore and out. • • •

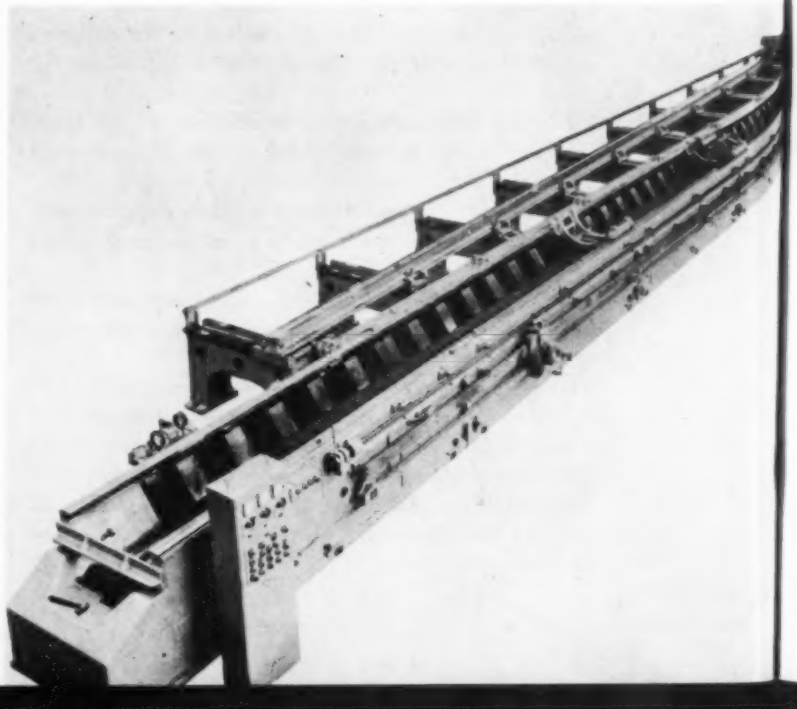
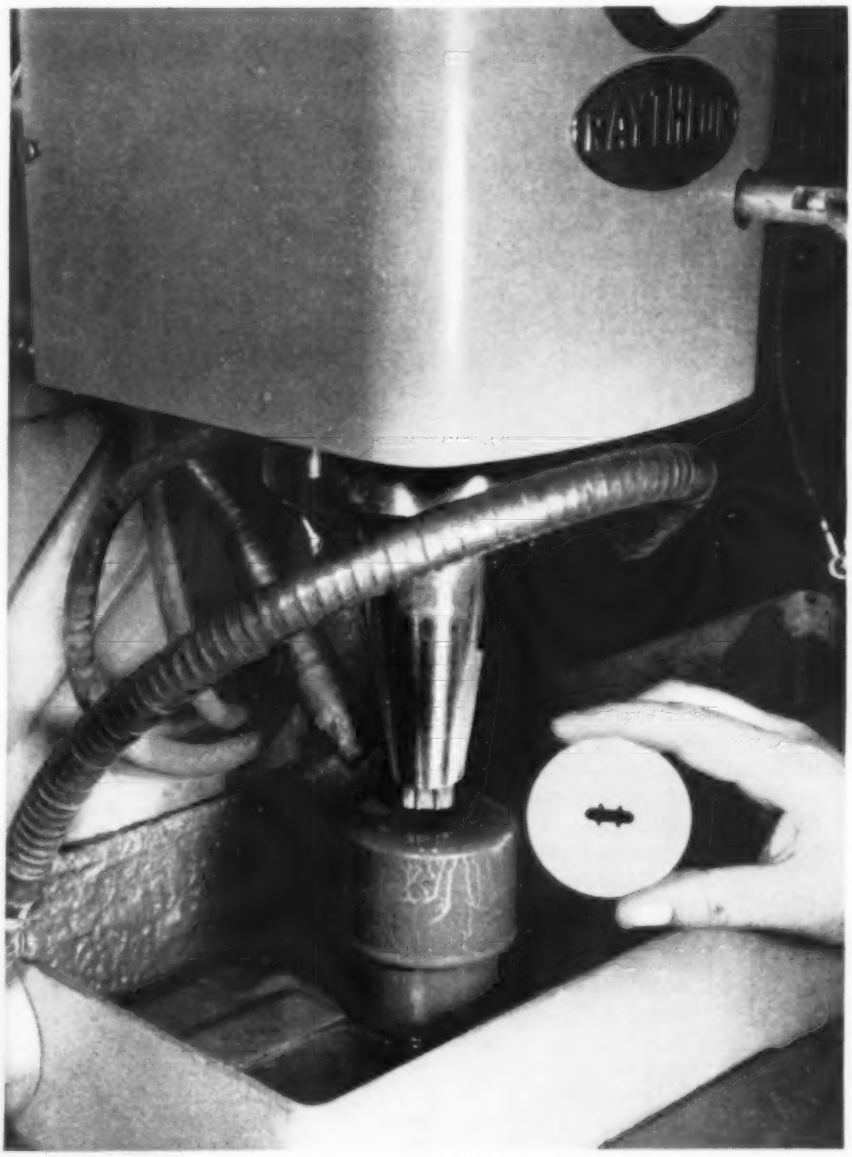


Figure 11. Barnes Drill Co., Model 36, horizontal hydraulically reciprocated machine with controls for automatic reduction of forward end of stroke to generate taper and sine bar control to finish taper hone.

Ultrasonic Machining calls for ultra-modern abrasive

. . . NORBIDE boron carbide*



The Raytheon Company, a leading manufacturer of ultrasonic machine tools, recommends NORBIDE abrasive grain as the ideal cutting agent for ultrasonic grinding applications. Ultrasonic Machine Tools convert electric current into mechanical vibrations at rates up to 25,000 cycles per second, and drive abrasive against the work with an impact force 150,000 times the abrasive's own weight. In so doing they can machine an exact counterpart of the shaped tool face into the workpiece, as shown here.

With the tremendous increase in the demand for accuracy beyond the range of conventional machining, Norton NORBIDE abrasive is a vital aid to the exceptionally high precision performance of modern ultrasonic machine tools.

NORBIDE boron carbide grain is second only to diamonds in hardness. Compared to silicon carbide grain, it provides the same degree of finish, but being less friable maintains size and speed of cut for a much longer period of time.

Ultrasonic machining is of major importance in the electronics and metalworking industries, as well as in the manufacture of intricate jewelry and fine glass and laboratory ware. Materials machined include alumina, carbon blocks, ceramics, diamonite, ferrite, germanium, granite, graphite, silicon, tungsten, mother-of-pearl, sapphire, tool steel, carbide and other alloys. Operations include shaping, slicing, trepanning, engraving, cutting of intaglios, dicing, drilling and multi-drilling. In all applications, on all materials, NORBIDE abrasive grain is essential to high precision, sharp-edge accuracy without chipping, distorting or otherwise damaging the workpiece.

Your Norton Man can give you details on how ultrasonic machining with NORBIDE abrasive may improve and economize your production. See your Norton Distributor or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

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Standard Time Data For Grinding Part IV

Part IV of this series will cover oscillating type cylindrical grinding and describes the multi-variable chart for the job-shop type operations or production. Part I described Standard Time Data development and its application to tool grinding. Part II covered vertical spindle surface grinding and part III described application to plunge type cylindrical grinding. The final part will cover application of Standard Time Data to centerless and snagging.

By E. A. CYROL and R. L. BORCK
E. A. Cyrol & Co., Chicago, Ill.
Management Consultants

● Continuing our treatment of center-type cylindrical grinding, we will give a sample study of oscillating type operations. Again we suggest that the actual time values serve as a guide for standard data studies to be made in each shop doing this type of grinding. They can prove useful as a check on values obtained by time study.

Machines available for this portion of the study are as follows:

Norton 6 x 18
Norton 6 x 30
Brown & Sharpe No. 20—10 x 18
Brown & Sharpe No. 5—4 x 18
Landis 4H Plain 4 x 18

Piece Handling Elements—Automatic and Hand Operated Grinders

The elements listed below and their descriptions cover in detail the work done by the operator to perform each element. The values shown represent the amount of time allowed for an average operator working at a normal pace to execute the element properly.

1. Position and Remove Dog .080 Min.
   As Before.
2. Pick Up and Aside Piece to Skid .046 Min.
   As Before.
3. Grease Centers .045 Min.
   As Before.
4. Gage Piece Figure 13, Chart 6
   As Before.

Machine Handling Elements

Elements listed below and their descriptions cover in detail the work done by the operator to perform each element. The values shown represent the amount of time allowed for an average operator working at a normal pace to execute the element properly.

1. Pick Up and Aside Piece Figure 13, Chart 5
   As Before.
2. Place and Remove Piece on Centers .077 Min.
   As Before.
3. Start and Stop Workhead .040 Min.
   As Before.
4. Engage and Disengage Table Oscillation .040 Min.
   This element includes time for operator to pull table oscillation lever out to start and push lever in to stop.
5. Advance Wheel to Grind (Oscillation) .071 Min.
   As Before.
6. Retract Wheel from Grind .030 Min.
   As Before.
7. Start and Stop Coolant .043 Min.
   As Before.
8. Advance Wheel to Grind (Spot Grind) .036 Min.
   As Before.
9. Position Table .075 Min.
   This element includes time for operator to position table longitudinally to one spot grind to the other.
10. Clean Up of Radius .055 Min.
    This element includes time for operator to position wheel to a previously machined radius and blend the grinding wheel to it.

11. Secure Piece in Steadyrest .100 Min.
As Before.

Gaging

The gaging time values as listed are based on the time allowed to check one dimension with gage listed.

Sheffield Gage:

Same as shown before.

Personal & Unavoidable Delay

Are same as previously discussed for plunge grind 11.1% allowance.

Explanation of Work Sheet for Oscillating Grind

A sample time is calculated on the following pages through the use of the Standard Data Work Sheet. This example is intended to serve as a guide to determining a production standard with the application of the Standard Data described in the preceding pages of this write-up.

1. Fill in upper right hand corner of work sheet (Figure 14) with part number, operation number, department number, type machine, and description of operation.
2. Fill in upper left hand corner of work sheet with type of grind (plunge or oscillation), R.P.M. of work (Chart 2, all chart numbers refer to Figure 13 which shows back of work sheet). On a plunge grind standard you do not need No. of Table Strokes Per Min., or Feed Per Stroke. Obtain the weight of piece, and if using an arbor also add weight of arbor to piece. Fill in diameter and tolerance.
3. Fill in elements pertaining to "Machine Handling Time."
   a. To find value for "Pick Up and Aside Piece," see reverse side of work sheet and refer to Chart No. 5, select value to correspond with weight, and enter in total column.
   b. Enter value of "Position and Remove Piece from Centers" in total column.
   c. Enter value of "Start and Stop Workhead" in column when piece is run on hand operated machine, on automatic machines the workhead starts and stops during the advance and retract of the wheel.
   d. Enter value for "Advance Wheel to Grind." (Oscillating).
   e. Enter value for "Retract Wheel."
   f. Enter value for "Position Table to and from Piece" when table must be cleared to remove piece and to position piece in centers when there is a spot grind allowed.
   g. Enter value for "Secure Piece in Steady Rest" when routing calls for a steady rest.
   h. Enter value for "Stone Corner" when routing calls for Stone Corner.
   i. Enter value for "Start and Stop Coolant" when using hand operated machine, on automatic machines the coolant starts and stops

Oscillating Grind Chart # 2

Cu. In. /.001/ In. Lgt.	Diameter Over	Diameter Thru	R.P.M. of Work	Type I Table Travel Inches/Min.	Type I Lap Time Min/Inch	Type II Table Travel Inches/Min	Type II Lap Time Min/Inch
.0012		.750	310	388	.0026	.026	233	.0043	.043
.0014	.750	.875	242	303	.0033	.033	182	.0055	.055
.0016	.875	1.000	230	288	.0035	.035	173	.0058	.058
.0018	1.000	1.125	205	256	.0039	.039	154	.0065	.065
.0020	1.125	1.375	175	219	.0046	.046	131	.0076	.076
.0022	1.375	1.500	166	208	.0048	.048	125	.0080	.080
.0024	1.500	1.750	142	178	.0056	.056	107	.0093	.093
.0028	1.750	2.000	125	156	.0064	.064	94	.0106	.106
.0031	2.000	2.250	111	139	.0072	.072	83	.0120	.120
.0039	2.250	2.500	107	134	.0075	.075	80	.0125	.125
.0043	2.500	2.750	98	123	.0081	.081	74	.0135	.135
.0051	2.750	3.250	90	113	.0088	.088	68	.0147	.147
.0055	3.250	3.500	83	104	.0096	.096	62	.0161	.161
.0053	3.500	4.000	76	98	.0102	.102	57	.0175	.175
.0069	4.000	5.000	66	66	.0120	.120	50	.0200	.200

Plunge Grind Chart # 1

Diameter Over	Diameter Thru	Time Per .001 Stock	Cut Time	Wheel Dress Allow.
	.250	.012	.032	.034
.250	.550	.015	.065	.068
.550	.850	.020	.095	.098
.850	1.150	.024	.110	.085
1.150	1.450	.028	.122	.097
1.450	1.700	.031	.134	.106
1.700	2.000	.035	.146	.121
2.000	2.300	.040	.158	.131
2.300	2.600	.044	.170	.141
2.600	2.900	.048	.182	.147
2.900	3.200	.052	.194	.200
3.200	3.500	.056	.206	.212
3.500	3.800	.060	.218	.227
3.800	4.100	.064	.230	.242
4.100	4.400	.068	.242	.261
4.400	4.700	.072	.254	.283
4.700	5.000	.076	.266	.309
5.000	5.300	.080	.278	.340
5.300	5.600	.084	.290	.378
5.600	6.000	.088	.302	.425

Recommended Feed Per Oscillation Chart # 3

	Feed Per Oscillation		
Diameter	0 - .875	.876 - 2.000	2.001 - 5.000
Type I	.0009	.001	.0012
Type II	.0006	.0008	.001

Wheel Dress Allowance for Oscillating Grind Chart # 4

Cu. In. Stock Removed Over	Cu. In. Stock Removed Thru	Pieces Per Dress	Allowance Per Piece	Cu. In. Stock Removed Over	Cu. In. Stock Removed Thru	Pieces Per Dress	Allowance Per Piece
	.025	50	.068	.250	.275	14	.243
.025	.050	43	.079	.275	.300	13	.262
.050	.075	37	.091	.300	.350	12	.283
.075	.100	32	.106	.350	.375	11	.309
.100	.125	27	.126	.375	.425	10	.340
.125	.150	24	.142	.425	.475	9	.378
.150	.175	21	.162	.475	.550	8	.425
.175	.200	19	.179	.550	.700	7	.486
.200	.225	17	.200	.700	.900	6	.567
.225	.250	16	.213	.900	1.000	5	.680

Chart # 5
Pick Up Piece Table to Skid

Weight	Pick Up	Aside
0 - 1#	.033	.034
1.1# - 5#	.040	.034
5.1# - 10#	.045	.034

Surface Gage	
Before .120	.04 each additional position
After .100	.04 each additional position
Flush Pin Ga.	
Before & After	.140

Gaging Time Chart #6
Sheffield Gage

Length	Under .0005 Tolerance
Solid	
0 to 2"	.028
2" & Over	.056
Thin Wall	
0 to 2"	.086
2" & Over	.114
.0005 to .001	
0 to 2"	.019
2" & Over	.030
.001 & Over	
All	.009

Shoulder Grinding Time Chart # 7

Width of Shoulder							
0 - .250	.251 - .375	.376 - .500	.501 - .625	.626 - .750	.751 - .875	.876 - 1.000	
.014	.030	.034	.040	.044	.048	.052	
Time Per .001 Stock Removed							

Wheel Touch Up Allowance for Shoulder Grind Chart # 8

Diameter	.250	.550	.850	1.150	1.450	1.700	2.000	2.300	2.600	2.900
Allowance	.036	.072	.085	.090	.102	.112	.128	.138	.150	.157
Diameter	3.200	3.500	3.800	4.100	4.400	4.700	5.000	5.300	5.600	6.000
Allowance	.211	.225	.240	.257	.277	.300	.327	.360	.400	.450

Figure 13. Back of the work sheet. Shown are the charts used to determine the times for various parts of the operation.

with the advance and retract of the wheel. Total all elements in column and enter the total time in column at right titled "Machine Handling Time."

4. Fill in elements pertaining to "Piece Handling Time."
   a. Enter value for "Pick Up and Aside Piece from Table to Skid" in total column.
   b. Enter value for "Position & Remove Dog," only when using dogs, not while using an arbor; arbors have stationary dog at driving end.
   c. From Chart No. 6 select the proper "Check O.D." value determined by length of grind and tolerances being held. Enter the value in the total column.
   d. When blueprint calls for a specific length to be held and centers are used, refer to Chart No. 6 and select value for "Surface Gage before Grinding." When face of shoulder is greater than ½" allow two additional positions. Total the values and enter in the total column. Values do not apply when an arbor is used.
   e. Paragraph "d" applies to "Surface Gage after Grinding," and is allowed when either arbors or centers are used.
   f. When an arbor is to be used and "Piece Handling Time" will be external, a time study check must be made for this element to derive the time allowance. Plot this time on spread sheet for future data.
   g. When "Greasing of Centers" is required, allow the value shown for an established frequency, i.e., 1/1, 1/2, 1/3, etc.

   Total all elements in column and enter the total time in column at right titled "Piece Handling Time."

NOTE: When this total time is exceeded by the grind and "Lap Out Time," it is to be circled out. Elements will be performed internal to the grind and "Lap Out Time."

Work Sheet on External Grinding Center Type (Plunge & Oscillation)

Grind - Oscillating ✓ Plunge			Part No. G29230 Oper. No. 290		
R.P.M. of Work 205 No. of Strokes Per Min. 21			Part Name SHAFT Dept. No. 738		
Feed Per Stroke .0005			Type Machine NORTON		
Grinding Wheel No. Weight 2#			Description of Oper. GRIND 1.064 DIA		
Dia. 1.064 Tolerance .002 Length 7.2					
Machine Handling Elements:			Piece Handling Elements:		
Pick up & Aside Piece Table to Machine (See Chart #5)	.074	.074	Pick up & Aside Piece Table to Skid	.046	.046
Position & Remove Piece from Centers	.077	.077	Position & Remove Dog	.080	.080
Start & Stop Workhead	.040	.040	Check O.D. (See Chart #6)		.086
Advance Wheel to Grind (Plunge)	.036	.036	Check Length Before (See Chart #6)		
Advance Wheel to Grind (Oscillation)	.071	.071	Check Length After (See Chart #6)		
Position Wheel to Shoulder	.045		Load & Unload Arbor		
Position Table to & from Piece	.075	.075	Grease Centers	.045	
Retract Wheel	.030	.030			
Secure Piece in Steady Rest	.100				
Engage & Disengage Table Oscillation	.040	.040			
Start & Stop Coolant	.043	.043			
Stone Corner	.086		Total Piece Handling Time		.212
Total Machine Handling Time		.486	Machine Handling Time		.486
DONE DURING GRIND →			Piece Handling Time		
Plunge Type Grinding Time (See Chart #1) Time per .001 Stock x No. of .001's Removed = Time ____ x ____ =					
____ Chart #1) Lap Out Time					
(See Chart # 7) Shoulder Grinding Time					
(See Chart #1) Wheel Dress Allowance Plunge Grind of O.D.					
(See Chart #8) Wheel Dress Allowance Shoulder Grind					
Oscillating Type Time of Table Travel Min./Inch x Length x 2 (Stock Removed / (Feed/Oscillation)) = Time (See Chart #2) .0065 x 7.2 x 2 (.014 / .001) = 1.310				1	310
(See Chart #2) Lap Out Time Time Per In. x Length = Time .065 x 7.2 = .468					468
(See Chart #1) Spot Grind Time Time Per .001 x No. .001's Removed = Time .024 x 12 = .288					288
			Clean Up of Radius or Shoulder .055		
(See Chart #4) Wheel Dress Allowance for Oscillating Grind					213
Date Entered			Total Minutes Per Piece	2	765
Previous Standard Hrs. 7.423			Personal and Unavoidable 11.1 %		307
Previous Pieces Per Hr. 13.5			Total	3	072
Date 5-17-56			20% Adjustment		614
Computed By GEORGE SMITH			Total Allowed Minutes Per Piece	3	686
Checked By			Hrs. Per 100 Pieces	6	143
Foreman Approved			Pieces Per Hr.	16	3

Figure 14. Front of the work sheet on which the times are recorded and tabulated.

Calculation of Grinding Times

5. OSCILLATING GRIND:
   a. Upon determining diameter to be ground, refer to Chart No. 2 and circle proper diameter group.
      Note: Grinding times values are shown as two types, these are as defined below:
      Type I—Total tolerance of .0005" or more.
      Type II—Total tolerance less than .0005". Thin wall piece with total tolerance of .0005" or less. Length of grind 2.500" or more with a total tolerance of .0005" or less on diameter.
   After determining type of grind, circle the time values shown in the proper columns opposite the diameter ground. Enter the time allowed for "Minutes Per Inch" in space provided. Determine length of grind and enter in space provided.

NOTE: When wheel cannot overlap piece due to a shoulder and part must be spot ground, subtract one (1) inch from length of grind. If grinding between two shoulders, subtract two (2) inches from length of grind.

   Determine amount of stock removed from blueprint, plus the T.I.R. allowed on previous operation and enter in the space provided, e.g.:

   Working diameter = 1.015 + .002 — .000
   Finish diameter = 1.000 + .0005 — .000

   Stock removed = .015 plus .002 T.I.R. = .017

   Use as .017".

   From Chart No. 3 select the proper "Feed per Oscillation," determined by diameter and type of grind, and enter in the space provided.

   Calculate formula and enter time in the total column.

   b. From Chart No. 2 select the proper "Lap Time" per one inch length of grind and enter in the space provided. Enter same length of grind as used above in space provided and multiply. Enter time in the total column.

   c. "Spot Grind Time" is only to be allowed when the wheel cannot overlap piece, such as to a shoulder or radius. In this case the operator must spot or plunge grind to .002" from size prior to start of oscillation grind. Spot grinding is calculated the same as "Plunge Grind."

   d. Enter "Clean Up of Radius or Shoulder" time in the total column only when there is a shoulder or radius on piece.

   e. From Chart No. 2 select the proper "Cubic Inches per .001 Stock Removed per 1 Inch of Length," (Cu. In./.000/In. Lgt.), for the diameter being ground. Multiply this by the total number of .001's stock removal, e.g., (.017" Stock Removal = 17), and by the total length of grind. From Chart No. 4 select the proper "Wheel Dress Allowance" time for the total "Cubic Inches of Stock Removed" and enter in the total column.

6. Add right hand column and enter total on "total Minutes Per Piece" line.

7. Add allowances and Calculated standard.

Multi-variable Chart

If your plant is of the job-shop type and the timestudy men or cost estimators find it difficult to keep up with the number of jobs being run, then a multi-variable chart should be developed for determining the production standards.

This part discusses the design and construction of such a chart from the data described for oscillating grinding. The reader attempting this approach for the first time should be familiar with the use and application of the Oscillating Grind data as the outlined steps are based on the charts, equations and terminology used for that data.

Determine Constant and Variable Elements:

Review the Data Worksheet and through the process of elimination sort the elements into two basic groups by the nature of their usage.

Constant Elements: Elements that generally apply to every piece and where the time variance would be slight if there was any change in the physcial characteristic of the part. These were chosen:

Piece Handling Elements	Minutes
Pick up and aside piece	.046
Position and remove dog	.080
Check O.D.	.086
	.212

Machine Handling Elements	Minutes
Pick up and aside piece	.074
Position and remove piece from centers	.077
Start and stop workhead	.040
Advance wheel to grind	.071
Position table to and from	.075
Retract wheel	.030
Eng. and dis-eng.	.040
Start and stop coolant	.043
	.450

Also any element that would be pro-rated into a per piece basis; such as, change pans, gage every 10 pieces, etc. Work that can be performed during the machine time should also be considered. The exhibits will show how this is treated.

Variable Elements: Elements that generally apply to every piece, however, the time changes due to a physical change in the part:
Grinding
Lap out
Wheel dress

The above variables are dependent upon the following characteristics of the part:
Diameter of part
Amount of stock removed
Type of grind
Length of grind

These characteristics in turn determine the following machine variables:

Table Travel, or Minutes per Inch
(Figure 13, Chart No. 2) of Oscillating Grind Data

Feed per Oscillation
(Figure 13, Chart No. 3) of Oscillating Grind Data

As the degree of accuracy of the final chart is determined by the elements that are chosen to

be used, some common "horse sense" is required to select only those elements that "can make the difference between a tight or loose standard."

Determine the Equation:

Basically the solution to our problem can be set out in a simple equation: Handling Time plus Machine Time equals the Total Time. However, the variables involved in determining the Machine Time and Lap Out Time make it necessary to lengthen our equation. The two equations shown on the Data Work Sheet can be used but must be turned around somewhat to facilitate the construction of the chart. The equations as shown are:

$$\frac{\text{Min./Inch of Table Travel x Length x 2}}{\text{Feed/Oscillation}} = \text{Grind Time}$$

Time Per Inch x Length = Lap Out Time

Referring to the tables on the work sheet, Figure 13, Chart No. 2 and Chart No. 3, for Type I grinding (Type II grinding will be discussed later) we will simplify the above equations. Both charts show that the Minutes per Inch, Lap Out and Feed are based on the diameter of the work therefore eliminating the length of the grind as our first change in the two equations. The second change will come about through simplification of the equation by multiplying the Minutes per Inch by 2.[1] Make up a construction table as shown in Figure 15 to illustrate this multiplication.

Our equation should now read thus:

$$\text{Min./Inch x } \frac{\text{Stock Removed}}{\text{Feed/Oscillation}} + \text{Lap Time} = \text{Min./Inch of Length}$$

As the equation is still awkward to work with, due to that part of the equation requiring the Stock Removed to be divided by the Feed per Oscillation, we want to determine a common multiplier,[2] therefore we make up another construction table as shown in Figure 16. This table is different than the first table (Figure 15) inasmuch as we must lay out the scale for the amount of stock to be removed. The first table had the diameter scale pre-established from .750" to 5.000" with units of division ranging from .125" to 1.000" increments. For our exhibit we have chosen .002" increments and arranged our scale from .008" to .030" stock removal. These scales are used in the final chart and here again the degree of accuracy is dependent upon the selection or refinement of the scales.

The next step would be to simplify the application of the Wheel Dress Allowance. (Chart No. 4 Figure 13.) A few slide rule checks show that the wheel dressing time would be approximately 12% of the total grinding and lap out time. The final equation can now be expressed as follows:

Min./Inch x Number of Osc. + Lap Time + 12%* x Length + Handling = Time

*12% of total grind and lap time per inch of length.
[1]Total minutes for up and back of oscillating cycle. The number of oscillations could be multiplied by two, however, being industrial engineers the job was made easier by keeping the multiplier simple.
[2]Stock Removed / Feed/Oscillation = Number of Oscillations

TYPE 1 Oscillating Grind

Diameter of Stock	Table Travel Min./Inch	Min./Inch x 2	Lap Time
.750"	.0026	.0052	.026
.875	.0033	.0066	.033
1.000	.0035	.0070	.035
1.125	.0039	.0078	.039
1.375	.0046	.0092	.046
1.500	.0048	.0096	.048
1.750	.0056	.0112	.056
2.000	.0064	.0128	.064
2.250	.0072	.0144	.072
2.500	.0075	.0150	.075
2.750	.0081	.0162	.081
3.250	.0088	.0176	.088
3.500	.0096	.0192	.096
4.000	.0102	.0204	.102
5.000	.0120	.0240	.120

Figure 15. Construction table showing the multiplication of machine table travel by 2. Tables of this type aid in the construction of a multi-variable chart as data information is kept together in condensed form. Figures used are from Chart 2, figure 13, of oscillating grind data.

TYPE 1 Oscillating Grind
Recommended Feed Per Oscillation

Amount of Stock Removed	Stock Removed / Feed/Oscillation = No. of oscillations		
	Diameters 0-.875 Rec. Feed .0008	Diameters .876-2.000 Rec. Feed .0010	Diameters 2.001-5.000 Rec. Feed .0012
.008"	10	8	7
.010	13	10	8
.012	15	12	10
.014	18	14	12
.016	20	16	13
.018	23	18	15
.020	25	20	17
.022	28	22	18
.024	30	24	20
.026	33	26	22
.028	35	28	23
.030	38	30	25

Figure 16. Construction table showing the dividing of the "Stock Removal" by the "Recommended Feed Per Oscillation." Figures used are from Chart 3, figure 13, of oscillating grind data.

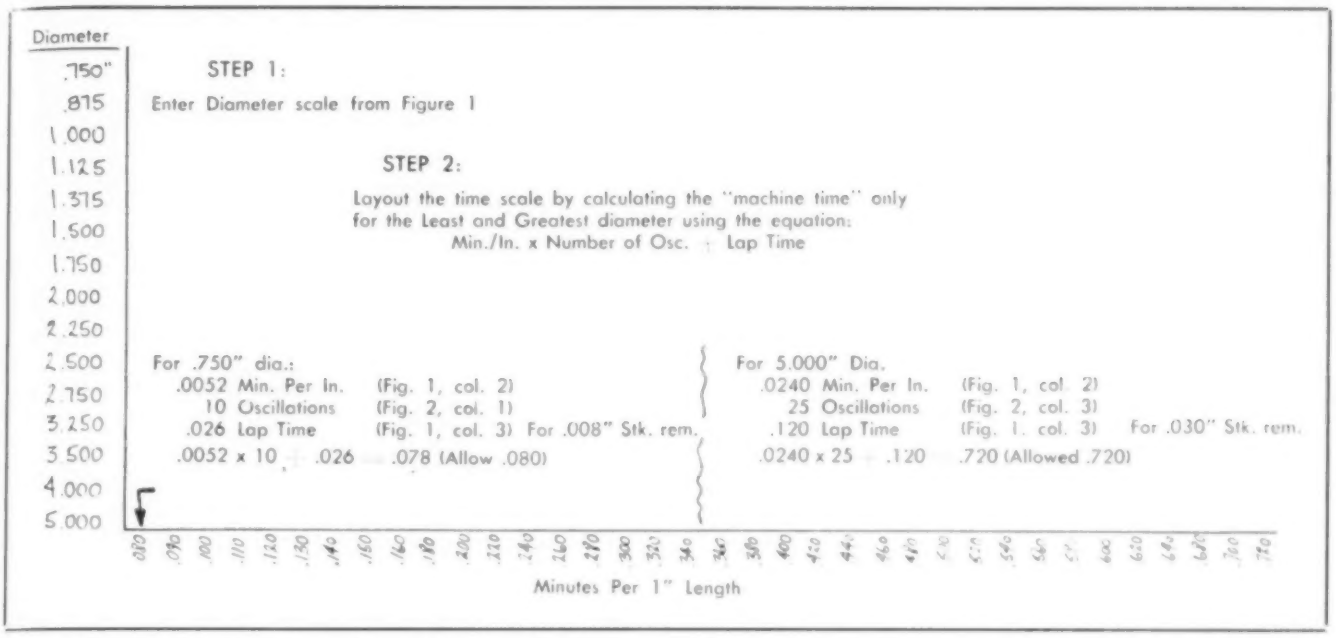
Diameter
.750"
.815
1.000
1.125
1.375
1.500
1.750
2.000
2.250
2.500
2.750
3.250
3.500
4.000
5.000
STEP 1:
Enter Diameter scale from Figure 1
STEP 2:
Layout the time scale by calculating the "machine time" only for the Least and Greatest diameter using the equation:
Min./In. x Number of Osc. + Lap Time
For .750" dia.:
.0052 Min. Per In. (Fig. 1, col. 2)
10 Oscillations (Fig. 2, col. 1)
.026 Lap Time (Fig. 1, col. 3) For .008" Stk. rem.
.0052 x 10 + .026 = .078 (Allow .080)
For 5.000" Dia.
.0240 Min. Per In. (Fig. 1, col. 2)
25 Oscillations (Fig. 2, col. 3)
.120 Lap Time (Fig. 1, col. 3) For .030" Stk. rem.
.0240 x 25 + .120 = .720 (Allowed .720)
Minutes Per 1" Length

Figure 17. Starting the multi-variable chart, a known dimensional scale is entered and the equation is solved for the "Machine Time." This provides the time scale. Increments of .010 minute and .020 minute were used. Unlike the graph, a "box" is used for the time and dimension instead of a "line."

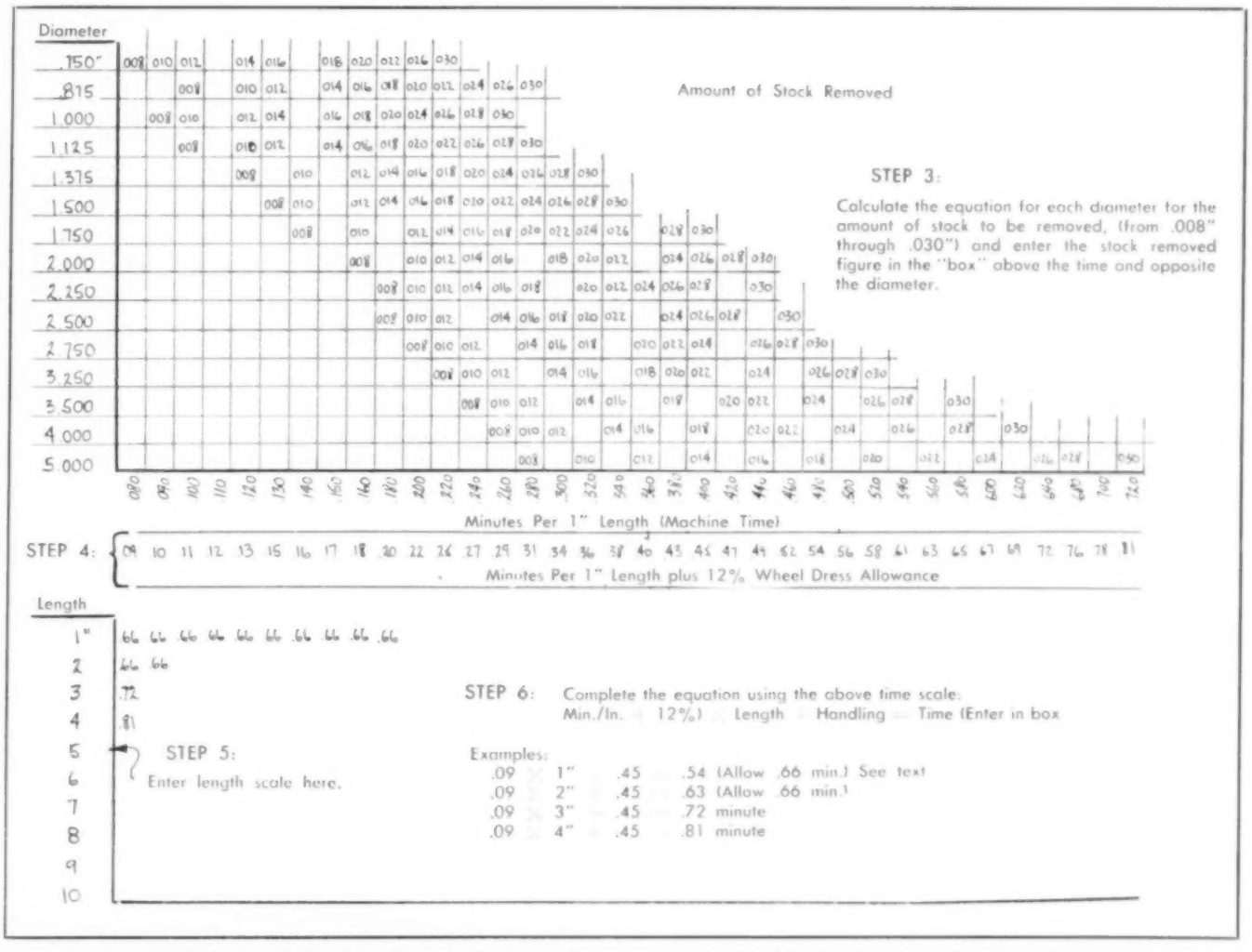

Figure 18. When performing Step 3 it must be remembered to change multipliers when computing the time for the larger diameters. This is necessary due to the larger diameters having a heavier feed recommended, see figure 16.

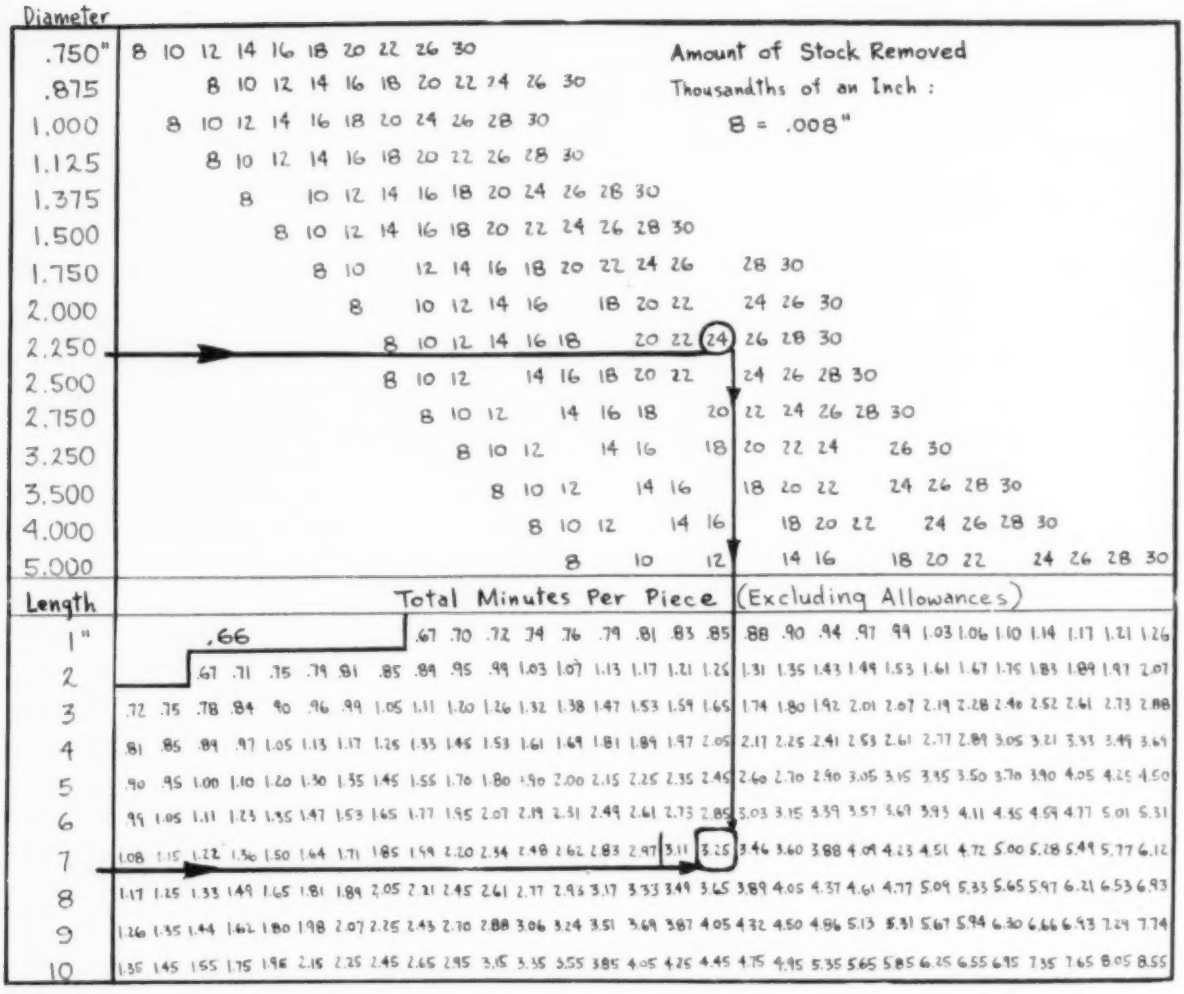

Figure 19. Completed chart illustrating the "route" to determine "Minutes Per Piece".

Construct the Chart:

Starting with cross-hatch paper, ruled 4 to the inch, lay out the diameter scale vertically in the upper left hand corner. Now lay out a time scale horizontally to and below the diameter scale. Figure 17. This time scale is determined in the same manner a graph would be drawn, it should encompass the least and the greatest time that would be encountered in the calculation of the first part of the equation: Min./In. x Number of Osc. + Lap Time. The time scale can be labeled, "Minutes per 1" Length." With practice the choosing of time increments will come easier.

Referring to Figure 15, multiply the Minutes per Inch, (Column 2), for the first diameter shown (.750") by the Number of Oscillations shown in Figure 16 for the proper feed recommended for this diameter, (Column 1), and add the lap time shown in Column 3 of Figure 15.

.0052 x 10 + .026 = .078 Minutes for .008" stock removal

Locate the minutes on the time scale of the chart that is closest to the .078 minutes, which will be the .080 minutes, projecting upward from these minutes and opposite the diameter of .750" enter in the box the amount of stock removed, .008". Figure 18.

Continue the calculations for this same diameter for the remaining stock removal figures:

.0052 x 13 + .026 = .094 Enter .010" above .090 Min.
.0052 x 15 + .026 = .104 Enter .012" above .100 Min.
.0052 x 19 + .026 = .120 Enter .014" above .120 Min.
Et cetera

Without getting lost, and remembering to change to the other multipliers when working with the larger diameters (columns 2 and 3 of Figure 16), proceed to fill out the chart. The chart should look like Figure 18.

Referring back to our equation we can at this time calculate and enter the 12% Wheel Dress allowance. This is done simply by multiplying the time scale by 112% and entering the new time directly below the original time scale. Here the time is corrected to two decimal places only:

.080 x 112% = .09
.090 x 112% = .10
.100 x 112% = .11
Et cetera, see Figure 18.

Work Sheet on External Grinding Center Type (Plunge & Oscillation)

Type Grind — Oscillating ✓ Plunge			Part No.	Oper. No.	
R.P.M. of Work	No. Of Strokes/Min.		Part Name Shaft	Dept. No.	
Feed Per Stroke			Type Machine Norton		
Grinding Wheel No.	Weight 2#		Description of Oper. Grind 2.26 Dia.		
Dia. 2.250 Tolerance .0015	Length 6.5"				
Machine Handling Elements:			Piece Handling Elements:		
Pick up & Aside Piece Table to Machine (See Chart #5)		.074	Pick up & Aside Piece Table to Skid	.046	.046
Position & Remove Piece from Centers	.077	.077	Position & Remove Dog	.080	.080
Start & Stop Workhead	.040	.040	Check O.D. (See Chart #6)		.008
Advance Wheel to Grind (Plunge)	.07[illegible]		Check Length Before (See Chart #6)		
Advance Wheel to Grind (Oscillation)	.071	.071	Check Length After (See Chart #6)		
Position Wheel to Shoulder	.045		Load & Unload Arbor		
Position Table to & from Piece	.075	.075	Grease Centers	.045	
Retract Wheel	.030	.030			
Secure Piece in Steady Rest	.10[illegible]				
Engage & Disengage Table Oscillation	.040	.040			
Start & Stop Coolant	.043	.043			
Stone Corner	.086		Total Piece Handling Time		.134
Total Machine Handling Time		.450	Machine Handling Time		.450
			During Mach. Time Piece Handling Time		
Plunge Type Grinding Time (See Chart #1)	Time per .001 Stock x No. of .001's Removed = Time ____ x ____ =				
(See Chart #1) Lap Out Time					
(See Chart #7) Shoulder Grinding Time					
(See Chart #1) Wheel Dress Allowance Plunge Grind of O.D.					
(See Chart #8) Wheel Dress Allowance Shoulder Grind					
Oscillating Type (See Chart #2)	Time of Table Travel Min./Inch x Length x 2 (Stock Removed / Feed/Oscillation) = Time .0072 x 6.5" x 2 (.024 / .0012) =				1.872
(See Chart #2) Lap Out Time	Time Per In. x Length = Time .072 x 6.5" =				.468
(See Chart #1) Spot Grind Time	Time Per .001 x No. .001's Removed = Time ____ x ____ =				
(See Chart #4) Wheel Dress Allowance for Oscillating Grind			Clean up of Radius or Shoulder .055		.425
Date Entered			Total Minutes Per Piece		3.215
Previous Standard Hrs.			Personal and Unavoidable		
Previous Pieces Per Hr.			Total		
Date			20% Adjustment		
Computed By			Total Allowed Minutes Per Piece		
Checked By			Hrs. Per 100 Pieces		
Foreman Approved			Pieces Per Hr.		

Figure 20. Work sheet for cylindrical grinding which is used as an example for the use of the multi-variable charts.

The next step for constructing the chart is to establish the "Grinding Length" scale. This scale is entered vertically below the diameter scale and for our exhibit we have chosen 1" increments up to 10". Figure 18.

To complete the equation and chart, the "Minutes Per 1" Length" is multiplied by the length shown and the Piece Handling or Machine Handling time is added to this and entered in the box opposite the length and below the minutes per inch multiplied. As this data involves manual time that can be performed during the machine time, we need only be concerned with the Machine Handling Time for most calculations. However, where the machine time is less than the .21 minute for Piece Handling, the sum of .66 minute (Piece Handling plus Machine Handling) is entered in the boxes where applicable. Figure 18.

The final step to our chart is to clean it up by the removal of construction time scales and notes, and to omit or combine empty spaces for easier reading. The finished chart with notes on its usage should look like Figure 19.

Check it out with the sample work sheet used for Oscillation Grinding, Figure 20. . . . It checks hurrah! • • •

This is the fourth of a five-part series on Standard Time Data for Grinding. The last part will cover snagging, and centerless grinding. Reprints of the complete series will be available upon completion of publication. Price of quantities up to 25 will be $1.00 each. Discount will be made for larger orders.

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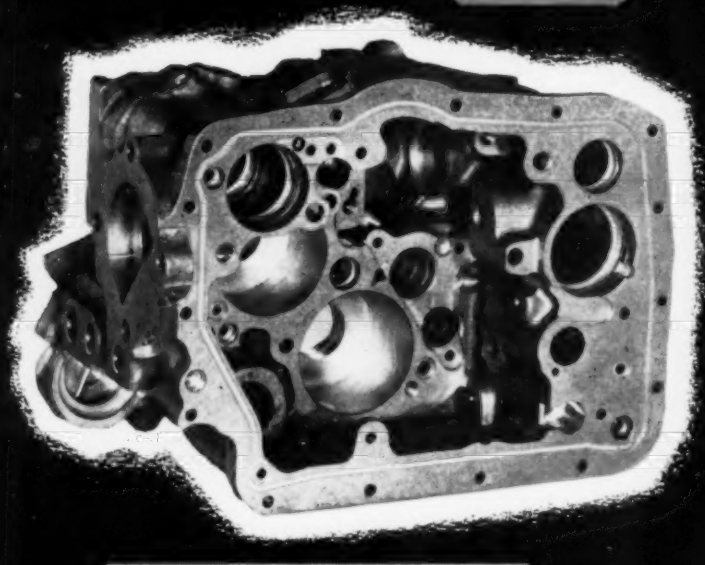

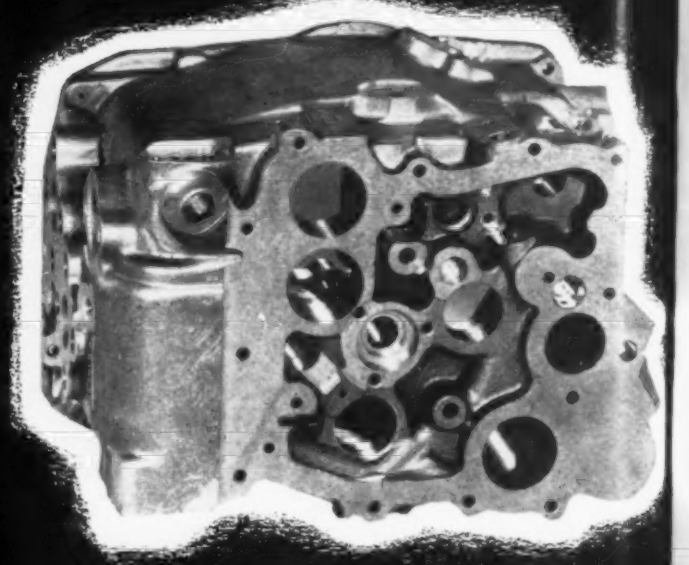

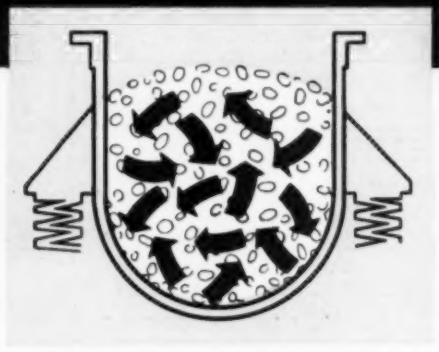

CONSTANT OVERALL ABRASIVE ACTION—The Vibratron work zone extends throughout the abrasive mass. Every surface is subject to constant vibrating abrasive action.

NO MORE MANUAL HANDLING of parts and media. A built-in removable separator does the job. There's no need for an extra separator.

COMPLEX ALUMINUM CASTINGS DEBURRED 2 at a time . . . in 15 minutes . . . . . the **VIBRATRON** way!

Woodward Governor Co., Rockford, Ill., long a leading manufacturer of all types of governors for prime movers, manufacture such highly precise equipment as jet engine fuel control systems. Precise finish and dimensional tolerances are a must! The fuel control shown above was previously hand deburred and then tumbled in a multiple compartment machine for 1 hour. Now . . . these cases are processed *2 at a time in 15 minutes* in the Vibratron. No hand operation is required and the finish is more uniform.

IF YOU NEED HELP ON A FINISHING PROBLEM, *Write or Phone today* FOR FULL PARTICULARS. IT WILL PAY YOU TO GET THE FACTS ON VIBRATRON PROCESSING.

ROTO FINISH

ROTO-FINISH / RANSOHOFF

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American Society for Abrasives

National Convention

Pittsburgh Chapter will be host to the first national convention, to be held at the Hilton Hotel, Saturday April 9.

Starting with registration at 9:30 a.m., a full day's activity is planned, with meetings both morning and afternoon, and the dinner meeting scheduled for 7:00 p.m.

Each chapter is entitled to send three delegates to the convention.

Western Michigan

Brand new markets are developing for grinding wheels capable of handling today's exotic new materials, George P. Burns, vice president, Van Norman Machine Co., told members and guests of the Western Michigan Chapter at their February meeting in Grand Rapids. He urged the members to start research and development programs that will help to open the new markets.

As an example of developments taking place in the machine tool industry, Mr. Burns cited crush forming for both centerless and center grinding machines.

Chicago Chapter

Around Chicago the worst in weather may soon be known as "ASA weather." This time it was a Tuesday blizzard that left plenty of mementos on Thursday and cut attendance down to about 35 members and guests.

Those who attended the February 11 meeting, however, heard an informative slide-illustrated discussion, "Inside and Outside the Grinding Wheel," by Robert C. Fisher, manager of abrasive engineering, Cincinnati Milling Machine Company, Grinding Wheels Division.

A. L. Ball, technical consultant, Bay State Abrasive Products Co., Westboro, Mass., will talk on "The Nature and Function of Abrasive Bonds," Thursday, March 10, at Nielsen's Restaurant, 7330 North Ave.

Officers of the Chicago Chapter get together after the January meeting. From left to right: Bill Reid, treasurer; Henry Hoppe, secretary; Bob Etherton, first vice president; Stan Ziegler, president; Gilbert Blake, Norton Company, speaker of the evening; Jim Marek, second vice president; Joe Stiak and Ken Jeppsen, board of governors. Missing are Tom Curtiss and Art Heine of the board of governors.

Abrasives Seminar

The abrasives seminar held by the Long Island Chapter on January 25, 26, and 27 (see GRINDING and FINISHING, February, page 23) attracted an attendance of approximately 70 each night, most members and guests taking in all three sessions. It was reported as a highly informative venture.

Kenneth Bates, of Norton Co., Worcester, Mass., was the speaker each night. During the first portion of each night's presentation, he showed films, elaborating on the material.

After a coffee break, the second half of each program was a question-and answer period on the subject.

Flint Chapter

The January dinner meeting of the Flint Chapter was held at the McNiven Hotel, Frankenmuth, Michigan, on January 20, 1960.

The speaker was **Gilbert R. Blake,** product safety engineer, Norton Co., Worcester, Mass., who discussed the importance of good safety habits.

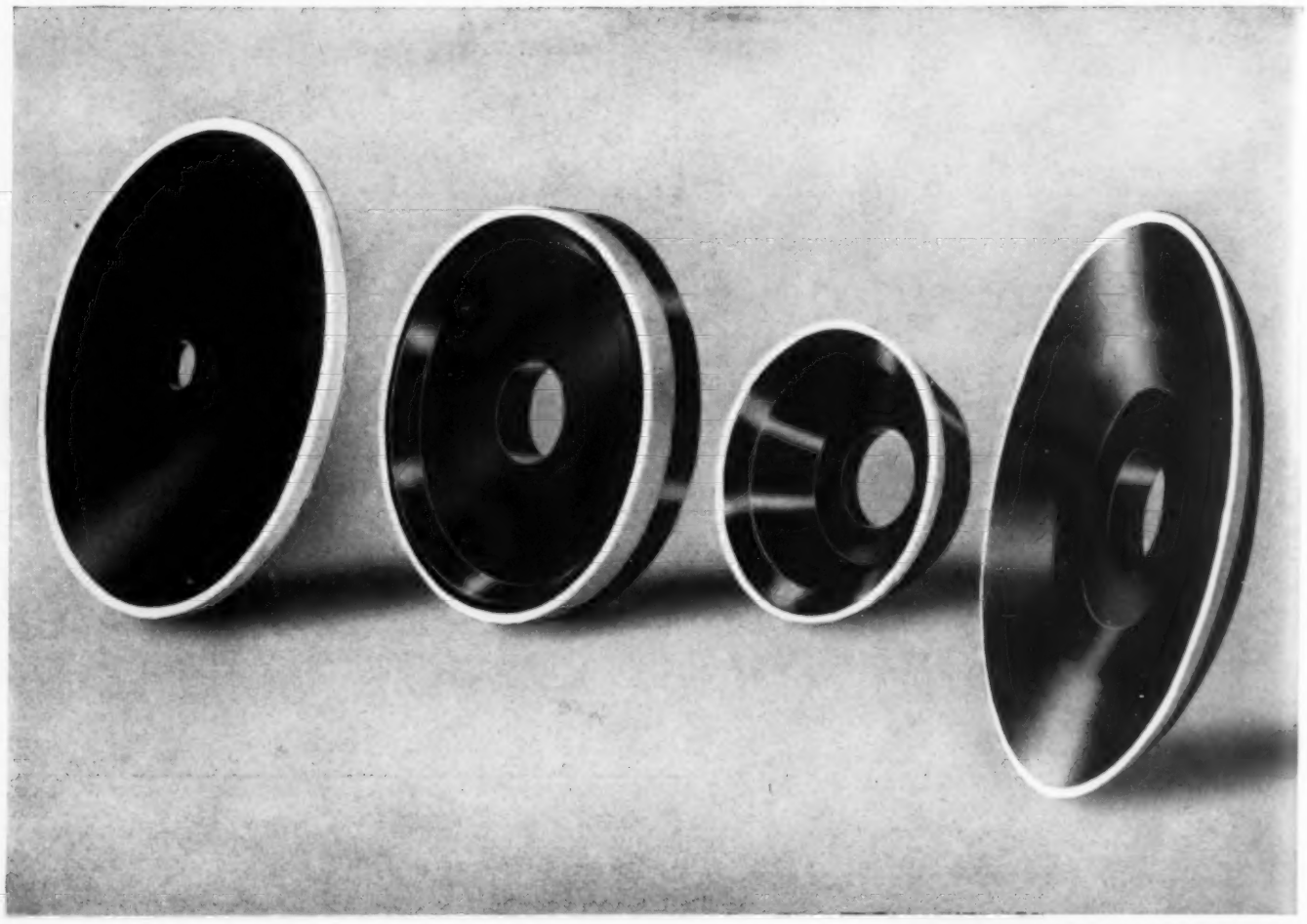
New Jersey Chapter

Peter Van Ekelenburg, of Mattison Machine Works, Rockford, Illinois, spoke on "Grinding vs. Machining" at the January meeting held at the Blue Shutter Inn, Union, New Jersey, on January 20. The speech was supplemented by a film.

Long Island Chapter

E. M. Hakanson, manager, Machine Tool Division of the Sheffield Corporation, Dayton, Ohio, was the speaker at the February meeting held Wednesday, February 10, at the Wheatley Hills Tavern, Westbury, New York.

For the March meeting, to be held March 9 at the same place, a representative of S. C. Johnson & Son, Inc., of Racine, Wisconsin, will discuss coolants.



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Cut Cool and Free—Last Longer

Manhattan Diamond Wheels are engineered to give you faster, cooler cutting and longer life.

Advancements in Diamond Wheel construction and NEW RESINOID BOND developments fully utilize the advantages of both man-made and natural diamond insuring top performance from all Manhattan Diamond Wheels.

TRY Manhattan Diamond Wheels on your toughest application—find out for yourself how they perform in your plant—under your conditions—on your operation.

- New Bonds
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- Bonded for Specific Grinding Requirements
- Natural or Man-made Diamonds

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MANHATTAN RUBBER DIVISION—PASSAIC, N.J.

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Grinding and Finishing

MARCH, 1960

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Literature

1. Power Hand Tool. Twelve-page brochure describes the Hi-Torque Handee Grinder and accessories. It is reported to be a complete hand workshop, available with mounted wheels, cutter heads, cleaning brushes, buffing and polishing wheels, cut-off discs, drill-press stand, foot control, and other accessories. Descriptions and prices of either sets or individual items are listed. Chicago Wheel & Mfg. Co., Chicago, Illinois.

2. History of Metrology. Section I of this informative coverage of man's progress toward precision measurement includes the period from 4700 BC through 1850 AD. Chapters of the material have appeared in **The Sheffielder,** but this attractive 5½" x 8½" bulletin (No. M-HM-59) brings it together in convenient form for reference and connected reading. The Sheffield Corporation, Dayton, Ohio.

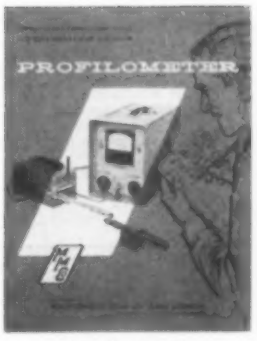
3. All-purpose Coolant Cleaner. An attractive two-color flier describes a filter, reported to be low-priced, but highly efficient, for toolroom and production grinders, hones, and similar applications. It describes the various grades of filter paper, charts the particle retention, flow rate, and price per 100-sheet package for each. Standard and optional equipment is listed, and pictures of typical installations are shown. The Kebby Company, Rockford, Illinois.

4. Machine Tool Leasing. This four-page brochure describes what is termed a brand-new approach to leasing arrangements for machine tools. Significant features of the plan are that there are no security deposits or down payments of any kind; finance charges are at low bank rates; lease payments do not begin until thirty days after shipment; and no extra charge for multi-shift operation. Jones & Lamson Machine Company, Springfield, Vermont.

5. Precision Accessory Equipment for Surface Plates. Bulletin "B" is a four-page, two-color publication which describes and illustrates a complete line of accessory equipment and special services for granite surface plates, including "Air Lift" angle blocks and riser blocks, parallels, toolmakers' flats and many others. Also described is the special field inspection for checking surface plate accuracy, and a relapping service for restoring the accuracy of worn plates. The Herman Stone Company, Dayton, Ohio.

(See Number 1)

(See Number 4)



(See Number 7)

6. Barrel Finishing Machines. Four-page, two-color Bulletin 100 describes in detail five series of horizontal barrel finishing machines with capacities ranging from 5.7 to 38.5 cubic feet. Special features of the machines are high-lighted in close-ups. Complete specifications are tabulated in a chart, and both standard and optional equipment is listed. Casalbi Company, Jackson, Michigan.

7. Surface Finish Measurement. New two-color, eight-page bulletin describes the practical features and applications of the Profilometer. It contains many pictures showing a variety of Profilometer combinations for measuring the surface finish of almost any production surface. The booklet shows typical applications in some well-known plants and illustrates the normal range of roughness readings. Also what happens when the cutting tool begins to get dull. Lists additional free publications. Micrometrical Manufacturing Co., Ann Arbor, Michigan.

8. Vibratory Feeders. Complete descriptions, data and specifications, along with more than 90 illustrations of small, heavy, and extra-heavy-duty standard electromagnetically vibrated feeders are contained in a new 32-page catalog on Syntron vibratory feeders. Spreader feeders, picking tables, conveyors and elevator feeders are also covered. Data is included on three pneumatically and hydraulically vibrated feeders for explosive materials, dangerous atmospheres, or for light fluffy materials. Syntron Company, 1253 Lexington Avenue, Homer City, Pennsylvania.

9. Honing Machines, Coolant Cleaning Equipment. Bulletin GC-60 is an 8-page brochure outlining the complete line of Barnes Drill Co. equipment, including honing machines, coolant cleaning equipment, transfer machines, production units, programming machines, and standard drills. Illustrations include applications and parts, and data includes machine capacities. Barnes Drill Co., 886 Chestnut St., Rockford, Illinois.

(See Number 9)

To obtain literature use Reader Service cards on page 57. Circle on the card the number which appears at the start of the paragraph describing the literature you request.

Why Cadillac Gage MICROHONES* Drilled Bores in Hydraulic Units

Since 1940, Cadillac Gage Company has been known for the quality of its high precision gages. Cadillac's production "know-how" in obtaining close tolerances has in recent years led to diversification in precision products.

From Gages to Tank Turrets

For example, Cadillac has developed and are now producing, for a prime contractor, hydraulic systems that control gun elevation and traverse of gun turrets on military tanks. In these units, geometric tolerances in millionths of an inch and a controlled surface finish are mandatory for smooth, dependable performance. That is why sleeve bores in control valves and lock valve bodies are Microhoned.

Simple collet-chuck fixturing permits fast, easy accommodation of various workpiece sizes. A Micromatic-designed tool speeds tool changeover.

Efficient Stock-Removal and High Precision

Because Microhoning is both a stock-removal and a precision finishing process, Cadillac engineers specified only two machining operations for the sleeve bores: drilling and Microhoning. Sleeves (hardened to 63 R "C") are Microhoned to generate roundness and straightness within 20 millionths of an inch tolerance over the full length of the bore. Also, in removing from .008" to .010" of stock, Microhoning consistently produces a surface finish of 4 microinches rms.

MMT-PE

Higher Quality — Lower Scrap

Every Microhoned bore is checked on a precision air gage . . . this 100% inspection insures highest quality control. Mating spools are selectively fitted to the Microhoned sleeve and clearance is held to between .00002" and .0001". Every sleeve and spool assembly must withstand a rigorous 3,000 psi leakage test. Scrap rate is practically nil.

With Micromatic equipment, Cadillac has substantially increased production; they control surface finish within closer limits; consistently generate specified geometric accuracy: and practically eliminate scrap. How Microhoning accomplishes these results is explained on facing page.

*Registered U.S. Pat. Off.

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FREE LITERATURE *continued*

10. Flexible Shaft Handpiece. A flier describing the new Foredom No. 55 angle type handpiece for flexible shaft handpiece has just been published. Small and light, the handpiece resembles a dentist's drill, is ideal for reaching otherwise inaccessible spots. It is sturdy enough for industrial use. Foredom Electric Company, Inc., Bethel, Connecticut.

11. Coated Abrasives. The December, 1959, issue of **Abrasive Tech,** a periodical from Behr-Manning Co., a division of Norton Company, contains a discussion of Metalite, a resin-bonded aluminum oxide coated abrasive for metalworking, together with a description of a new color film, "Wide Belt Metalworking," available on request for plant or group showings. Behr-Manning Co., Troy, New York.

12. Numerically Controlled Machines. A new guide book of numerically controlled machine tools is designed to help you decide whether or not you can use numerical control in your machining operations. The guide is an informative 20-page booklet containing basic information and approximate costs of getting into tape-controlled operations. Four sections: fundamentals; operation of different types: Numera-Trol; and questions and answers. Ex-Cell-O Corporation, Detroit, Michigan.

(See Number 12)

13. Inflated Polishing Wheels, Sanding Drums. New literature and catalogs with complete descriptions of Nu-Matic's expanded line of inflated polishing wheels, expanding polishing wheels, sanding drums, belt sanders and expanding cones is now available. In addition to catalog information, cost analysis sheets for comparing costs of set-up wheels vs. coated abrasives on typical operations are also offered. Nu-Matic Grinders Inc., Cleveland, Ohio.

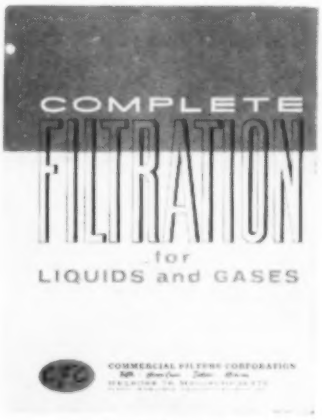
14. Diamond Re-setting Equipment. Flier describes equipment and materials for "do-it-yourself" diamond re-setting, offers truing and refacing service. Describes and illustrates methods. Diamond Tool Company, South Haven, Michigan.

15. **Cutting-Off Wheels.** Grinding Wheel Institute publication covering in text and pictures the general requirements for safe operation of thin abrasive wheels for cutting or slicing applications. The discussion is limited, however, to solid organic-bonded straight wheels whose thickness is less than 1/48 of diameter (up to 20" diameter) or 1/60 of the diameter for larger wheels. Types of machines, wheel mounting, work support, cutting techniques, causes of wheel breakage, and handling and storage are some of the major topics. Grinding Wheel Institute, Cleveland, Ohio.

16. **Coated Abrasives.** The December, 1959, issue of **The Abrasives' Workshop** leads off with an article about swing frame grinding with abrasive belts. Also described is a research project into the fundamentals of coated abrasives grinding. The Carborundum Company, Niagara Falls, N.Y.

17. **Bench Center and Surface Plate;** Surface Grinder. Two single-sheet fliers punched for standard binders give full details and specifications on K. O. Lee Company's Model BC3 bench center and surface plate, and their new Model S612 and S612H surface grinders. The first unit is portrayed as an accurate means of inspecting all types of work. Various applications are illustrated. The grinders, either hand or hydraulic models, are described as low cost precision equipment designed to handle much of the work customarily assigned to larger machines. K. O. Lee, Aberdeen, South Dakota.

18. **Filtration Equipment. Complete Filtration for Liquids and Gases,** a new 8-page catalog, gives a brief description of



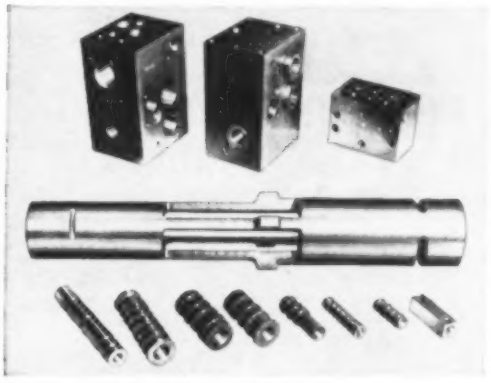
(See Number 18)

each of the products in the CFC line of filtration equipment. The line includes Fulflo, Delpark, Honan-Crane, and Michiana filters. Information is classified according to applications, operating pressures, and sizes. References are included for detailed bulletins on major items of equipment. Various types of filter media are described and illustrated. Commercial Filters Corporation, Melrose, Mass.

19. **Motorized Diamond Wheel Dresser.** Bulletin DW-160 is a two-page flier punched for a standard three-ring notebook and describing the features of Niagara Cutter motorized diamond wheel dressers. Primary advantages claimed for the unit are reduction in diamond waste, compact size, light weight and low cost. Niagara Cutter Division, Bollier-Damerell, Inc., North Tonawanda, New York.

How Cadillac Gage MICROHONES Drilled Bores in Hydraulic Units

Here's how Cadillac Gage Company uses just drilling and Microhoning to secure higher production, reduce costs and obtain high accuracy in producing precision bores for hydraulic units that control gun elevation and traverse of gun turrets on military tanks.



This representative range of sleeves and other hydraulic components include both soft and hardened steels.

MMT-PE

Microhoning Bores in Hard Steel

Following the drilling operation, bores are Microhoned in at least eight different sizes of sleeves that are hardened to 63 R "C". Bore diameters range from .250" to .875" and in lengths up to 5.50". From .008" to .010" of stock is removed in an average Microhoning cycle of about two minutes. A surface finish of four microinches, rms, is consistently obtained while generating roundness and straightness within 20 millionths of an inch tolerance over the full length of the bore. Also, because the free-floating Microhoning tool follows the neutral axis of the drilled hole, the bore location remains unchanged.

Microhoning Bores in Soft Steel

Another component of these hydraulic units is a cylinder whose bore is 1.625" in diameter and 19" long. Because the maximum stroke of the Hydrohoner machines being used is 15", the cylinder is turned end-for-end during the Microhoning of the bore. Following a deep-hole drilling, Microhoning removes from .012" to .015" of stock in generating a controlled surface finish and correcting geometric inaccuracies.

Microhoning Blind-End Bores

In addition to bores in hardened steel sleeves and soft steel cylinders, Cadillac also Microhones several bores in soft steel valve bodies. One of these is a blind-end bore. It is .625" in diameter, 1.75" long and has a $\frac{1}{16}$" relief at the bottom. Microhoning is specified to hold geometric tolerances within .0001".

In the processing of precision bores in a variety of components for hydraulic units, Cadillac Gage is giving versatile and tangible expression to "precision production through Microhoning."

MICROMATIC HONE CORP.
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FREE LITERATURE *continued*

20. Electrically-Aided Grinder. Flier illustrates and presents major features of Hammond's Model EG-10 oscillating electrolytic grinder, listing standard equipment and specifications in addition. Hammond Machinery Builders, Kalamazoo, Michigan.

21. Reinforced Wheels, Discs; Abrasive Mops. Two brochures with considerable information as to applications, one concerned with various shapes of grinding wheels, the other with abrasive mops, similar to flap-type wheels. Maximum speeds, sizes and grits available, recommendations for various kinds of material are included. C. Klingspor GmbH, Haiger-Dillkreis, Germany.

22. Hand Cleaner. Price sheet listing size, shipping weights, and prices of various sizes of containers of hand cleaner, ranging from 8-oz. bottles to 54-gallon drums. Metalloid Corporation, Huntington, Ind.

23. Finishing Methods for Carbon and Stainless Steels. A new data sheet contains detailed recommendations for producing selected finishes on carbon and stainless steels. Described in detail are satin finishes, butler finishes and bright finishes. Information includes abrasive compound recommendations, wheel speeds, and types of buffs. There is also a section on blending and simulating mill finishes on stainless steel for blending in weld marks and for the removal of tool and die marks. The Lea Manufacturing Company, Waterbury, Connecticut.

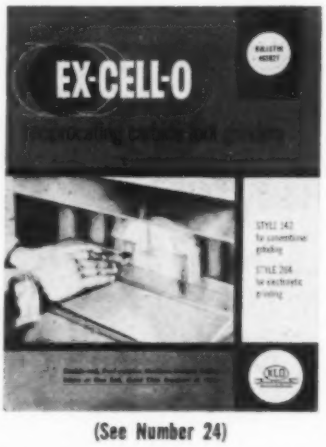
24. Reciprocating Tool Grinders. Two models of reciprocating tool grinders are illustrated and described in a new folder designated as Bulletin 465927. One model is built for conventional grinding, the other for the electrically-aided process. Both grinders are double-end, dual-purpose machines for grinding cutting edges at one end and chip breaker grooves at the other. The folder gives complete specifications for both models, shows accessories useful in sharpening tools. Ex-Cell-O Corporation, Detroit, Michigan.

25. Barrel Finishing. Four-page folder describes the Handee slide abrader, a small barrel suitable for finishing small parts or for experimental runs. The unit requires bench space only 16" x 25"; it is 20½" high. Recommendations for compounds and media are also included. Chicago Wheel & Mfg. Co., Chicago, Ill.

26. Gages, Drills. A new illustrated catalog of gages, taps, high speed and carbide drills, reamers, and end mills manufactured by Precision Twist Drill and Machine Co. features simplified pricing. Precision Twist Drill and Machine Co., Crystal Lake, Ill.

27. Abrasive Belt Splicer. Letter-size flier describes both bench and floor model splicers and a large electric press assembly for wide belts. A measuring counter for convenient measuring of belt lengths is also described. Advantages claimed for the splicing include reduction in inventories of belts, savings in man hours, reasonable price, reclamation of torn or damaged belts, and lower first cost through buying rolls instead of spliced belts. Econaway Manufacturing Company, Bellevue, Michigan.

28. Work Holding Devices. More than 70 items are shown in a new pocket-sized catalog, No. P100, recently announced by Chicago Tool and Engineering Co. These include drill press vises, production vises, air vises, rotary tables, and many others. The complete line of Palmgren products is illustrated and fully described in this 18-page publication, which includes specifications and prices. Chicago Tool and Engineering Co., Chicago, Illinois.



(See Number 24)

29. Quills for Grinding Spindles. A new 16-page catalog listing all quills for Bryant grinding spindles has recently been announced. Detailed instructions for ordering the proper quill for each spindle, including quill blanks finished complete except for overall length and wheel screw

NEW

AN EXCEPTIONAL DEVELOPMENT IN THE COMPOUNDING OF RUBBER CUSHIONED ABRASIVES

Semi-Firm Binder Brightboy GB

The addition of the Semi-Firm GB Binder to the Brightboy line introduces new, time-saving rubber-cushioned abrasive compounds of inimitable formulation and unusual versatility.

GB rounds out the Brightboy line—**the only complete, comprehensive STOCK LINE of multi-use rubber-bonded abrasives.** Wheels, sticks, rods and blocks for machine and manual operations bring a wide, revolutionary concept to finishing—work saving applications not previously associated with abrasive uses.

With the introduction of the new Semi-Firm GB Binder, the Brightboy line now consists of FOUR BASIC RUBBER-CUSHIONED BINDER GROUPS: ST, Soft, GB, Semi-Firm; BL, Firm; TT, Tough. New GB combines the advantages of the Soft ST Binder with the durability of the Firm BL. *Each* of these four basic groups is made in an extensive range of Aluminum Oxide and Silicon Carbide abrasive grains. An additional binder, Fine-Tex, is compounded with pumice abrasive. All are available from STOCK. You may have employed other methods or products in an endeavor to obtain the results which can now be achieved by new Semi-Firm Binder GB or other Brightboy Abrasives. Benefit from the new GB Binder—or the other Brightboy Binders. All JOB-MATCHED to your production in speeds and strength.

WRITE TODAY FOR

- LIST OF JOB-MATCHED BRIGHTBOY GRAINS AND TEXTURES
- APPLICATIONS, MACHINE SPEEDS
- SAMPLE HAND TABLET
- NEAREST DISTRIBUTOR'S NAME

WELDON ROBERTS Brightboy RUBBER CUSHIONED ABRASIVES

BRIGHTBOY INDUSTRIAL DIVISION
WELDON ROBERTS RUBBER CO.
95 North 13th Street Newark 7, N.J.

America's Pioneer Manufacturer of Rubber-Bonded Abrasives

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hole, are included. Also contained is complete information on wheel binder screws and special wrenches. The Bryant Chucking Grinder Company, Springfield, Vermont.

Barrel Finishing Equipment and Compounds. Four new technical process bulletins have recently been published by Tumb-L-Matic, Inc., Stamford, Conn.

30. "The Quicklustre No. 104 Wax Process," (Bulletin No. TPB-2) explains the low cost method developed for imparting lustrous or glossy material finishes to items not expected to retain their "sale" finish after a long period of use.

31. Bulletin TPB-4, entitled, "Finishing Plastic Buttons with Tumb-L-Matic's DL Process," goes into the procedures to be followed for the removal of shear marks, concavity and surface defects from raw button blanks, as well as the polishing of faced and drilled buttons.

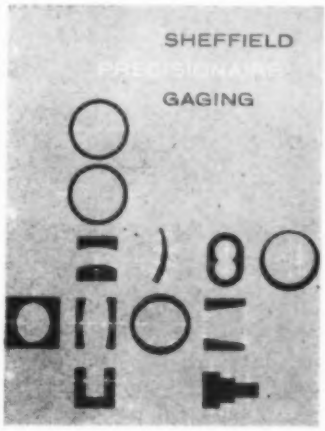
32. "No Wax, High Lustre Finishing with the DL Process," is the title of Bulletin TPB-3, which deals with the process developed for achieving color, lustre and texture directly comparable to that achieved by hand buffing.

33. "The Barrel Finishing of Resistor Leads" is covered in Bulletin TPB-5, offering information on the preparation of resistor leads prior to tin electroplating and hot dipping.

30-33. Tumb-L-Matic, Inc., Stamford, Connecticut.

190. Sam Safety Posters. Single copies of the six "Sam Safety" cartoons which have appeared in the last six issues of GRINDING and FINISHING are available on request as long as the supply lasts. Also available in quantities. Use the Reader's Service Card to request prices.

Air Gaging. A 50-page handbook on dimensional air gaging, reported to be one of the most comprehensive ever published, is entitled "Sheffield Precisionaire Gaging." Written especially for inspection personnel, gage designers, tool engineers, and quality control personnel, it describes in clear, non-technical language how to select the right amplification,



when to use long-range air gages, the advantages and principles of air gaging, and many other facets of dimensional control. Available to readers when request is made on company letterhead and position or title is given. Publication No. SPG-160 c/o The Sheffield Corporation, Box 893, Dayton 1, Ohio.

DYNAMIC POLISHING and DEBURRING

The GRIND-O-FLEX saves valuable production time in polishing and deburring rounded, contoured and flat surfaces. A flexible abrasive wheel that features **slashed** construction, type BL GRIND-O-FLEX practically envelopes the part with dynamic, moving abrasive.

Easy to use, economical, the GRIND-O-FLEX consists of a rugged hub that holds a number of simple-to-replace abrasive pads. No special tools are required to load the hub.

The pads, available in a variety of grits, wear evenly, exposing a continuously fresh abrasive surface.

Write today!.. for illustrated technical bulletin and price list.

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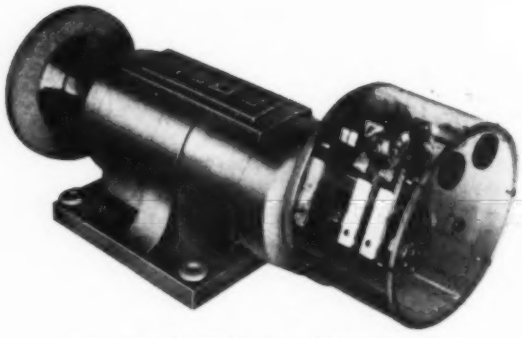
For Fast Removal Of Tough Metals Specify ELECTROLYTIC GRINDING

For Electrolytic Grinding Specify POPE PRECISION "ANOCUT" SPINDLES

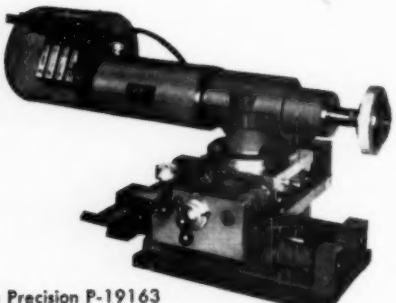
with total eccentricity of shaft less than fifty millionths (.000050")

Pope "Anocut" Spindles are available for 50 to 3000 amp. operation, motorized or belt driven with wheels up to 28" dia. They are equipped with built-in insulation and a *new* Pope rugged fork type, cool operating brush assembly for transmitting low voltage, high amperage current to the wheel.

To get the most production out of electrolytic grinding, you need Pope designed, precision built electrolytic grinding spindles. Let us have your specifications for quotations.



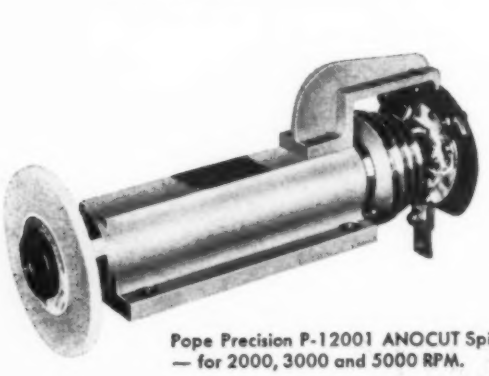
Pope Precision P-19162 ANOCUT Spindle; 1 to 20 HP, 1800 RPM.



Pope Precision P-19163 ANOCUT Spindle mounted on Pope heavy duty universal slide with indicators for measuring feed in ten-thousandths.

Pope Precision P-3007 ANOCUT Spindle — 10,000 RPM.

Pope Precision P-6651-XG-S4 ANOCUT Tilting Head for attaching to Cincinnati #2 Tool and Cutter Grinder.



Pope Precision P-12001 ANOCUT Spindle — for 2000, 3000 and 5000 RPM.

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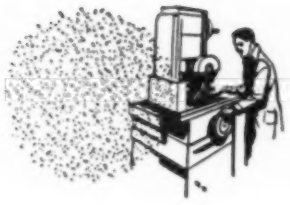

Equipment and Materials

Automatic Polishing, Buffing of Tubular Shapes

A new Acme automatic polishing and buffing machine that finishes round, square, hexagonal, or octagonal tubular metal parts has recently come on the market. The machine is said to be excellent for finishing plumbing hardware, lighting fixtures and tubular furniture. It can also be used for automatic deburring on tube-shaped parts, or parts with holes that permit them to be chucked on a mandrel.

Buffing wheels, abrasive belts, set-up wheels, or wire brushes can be used on the machine, depending on the operation.

The machine consists of a motorized head, reciprocating work table, and a cam-operated index mechanism for a group of mandrel assemblies mounted on the table. It can be made either as a unit or with separate table and adjustable head unit.

Standard models of the machine have a maximum table travel of 48". Parts up to 42" long may be handled. The machine occupies a floor space about 9' x 4'; it is about 6' high.

Acme Manufacturing Company, Detroit, Michigan.

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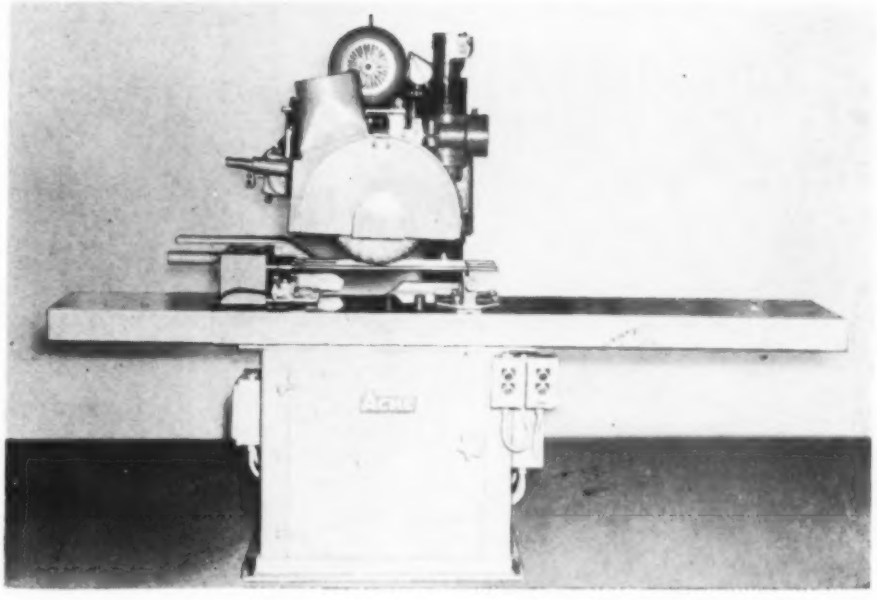
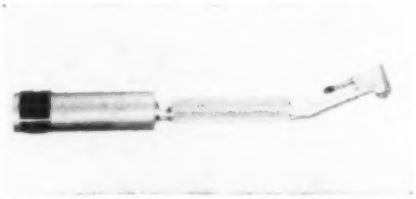


Flexible Shaft Handpiece Solves Difficult Finishing Problems

A new angle type handpiece has recently been brought out by Foredom Electric Company, Inc. Small and light weight (6¼" x ⅝" and weighing only 4 oz.) it resembles a dentist's drill.

Like a dentist's drill, it is useful for reaching otherwise inaccessible spots. It is sturdily built, it is said, to meet the needs of the electronic and instrument industries, as well as of tool, die, and mold work.

The No. 55 handpiece has a latch-type tool holder, hardened steel gears, and chromium finish. It is easily attached to any Foredom flexible shaft machine.



Equipped with two mandrels, it can be used with standard unmounted accessories and with very small dental-type burs, abrasive points, etc. It can be used without modification for grinding, deburring and polishing.

Foredom Electric Company, Inc., Bethel, Connecticut.

Use postpaid card. Circle No. 36

Overspeed Safety Device for Pneumatic Grinders

An overspeed safety device with an anti-defeat feature has been incorporated in Wilson pneumatic grinders.

The device is standard on all grinders with rated speeds of 7200 rpm or less, to supplement the governor. It is not needed on grinders with higher rated speeds, since their free speeds are below maximum safe wheel speeds.

The device cuts off air by a simple positive snap action if the governor becomes inoperative. Air remains off until the device is reset, an operation requiring removal of the throttle handle. This provision guards against bypassing the safety device by keeping the grinding in service without restoring the governor to normal operation.

The device is independent of the governor, and is not subject to wear,

since it functions only if rated speed is exceeded.

It does not alter the compact, lightweight design of the grinders, and may be added to equipment now in service if desired.

Thomas C. Wilson, Inc., Long Island City, New York.

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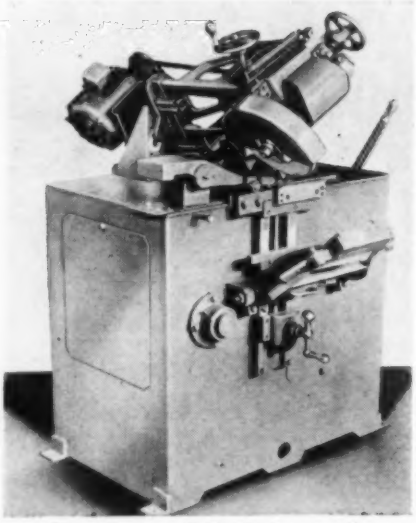
New Band Saw Grinders

The new Hanchett Series "A" Band Saw Grinding Machines recently placed on the market are now available with



attachments for full Universal saw sharpening applications. The new attachments consist of a continuously variable lift adjusting mechanism and a continuously variable feed adjusting mechanism. With these attachments, the Series "A" machines will sharpen any depth or any spacing of regular saw teeth without changing cams.

These attachments can now be furnished with the A-200 12" capacity machine, A-230 14" capacity machine and 4-240 16" capacity machine, which have proven exceptionally popular for standard sawmill applications.

Hanchett Manufacturing Company, Big Rapids, Michigan.

Use postpaid card. Circle No. 38

Rubber Protector Safeguards Gage Setting

A rubber protector for precision ring gages that covers and guards the original gage setting has recently been announced. It covers the outer edge of the gage and absorbs shocks caused by dropping or jarring the instrument.

The oil-resistant rubber cover is said to shield the adjusting and locking

screws, protect the gage from hand heat, and guard against passing rejects.

The serrated edge is also claimed to speed inspection because it provides a firmer and softer grip for the fingers. The guard is available in red for "no-go" in green for "go," and in white for master inspection use.

Swanson Products, Inc., West Hartford, Connecticut.

Use postpaid card. Circle No. 39

Surface Grinder with Automatic Down Feed

Incrematic down feed, a new automatic down feed device which permits operator to preset amount of stock to be removed and which automatically shuts off after stock removal, is now available on all Grand Rapids Saddle Type surface grinders from 6" x 18" to 24" x 48" table size.

Precision Grind Small Parts On A Fortuna

The Fortuna 200 series of cylindrical grinding machines provides accurate, dependable grinding of a wide variety of small parts—injection needles, servo valves, watch parts, or wherever highest accuracy is required. Parts can be ground between centers, with high-precision collets, in chucks, or on face plates.

With a Fortuna even unskilled operators can obtain extremely fine limits of accuracy—as close as .00002" (twenty millionths).

A Fortuna UME 200 Universal Cylindrical Grinding Machine

LME 200—For internal grinding.

RME 200—For external grinding.

UME 200—For universal grinding—with double-swivel grinding head if desired.

Also available—all types of precision internal grinding spindles—including high frequency spindles up to 180,000 r.p.m.

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COSA

Importers of Leading Precision Machine Tools
Nationwide Sales and Service
COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

IN CANADA contact COSA CORP. OF CANADA, LTD., 1160 Lakeshore Road, Long Branch, Toronto 14, Ont.

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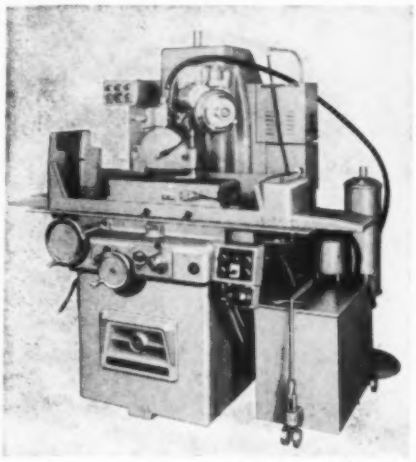
Incrematic down feed makes possible complete automatic surface and plunge grinding to extreme repeat accuracy with utmost simplicity. It permits the operator to direct dial the amount of stock to be removed in increments of .01" to .0001" and always leaves .0001" for finish pass before going into three pass "spark-out" which automatically shuts off machine.

For automatic surface grinding, the part to be ground is secured to the magnetic chuck or work surface of the



machine and grinding wheel is advanced until it makes contact with work. Then total amount of stock to be removed is preset. Rate of stock removal is selected and surface plunge selector is set so automatic feed receives "feed" impulses at each reversal of the machine saddle. Automatic cycle is set for surface grinding and auto-feed start button is pressed to place feed mechanism in operation.

Automatic plunge grinding is the same except surface plunge selector is placed in "plunge" position. In this position, the automatic feed receives the "feed" impulses at each table reversal.

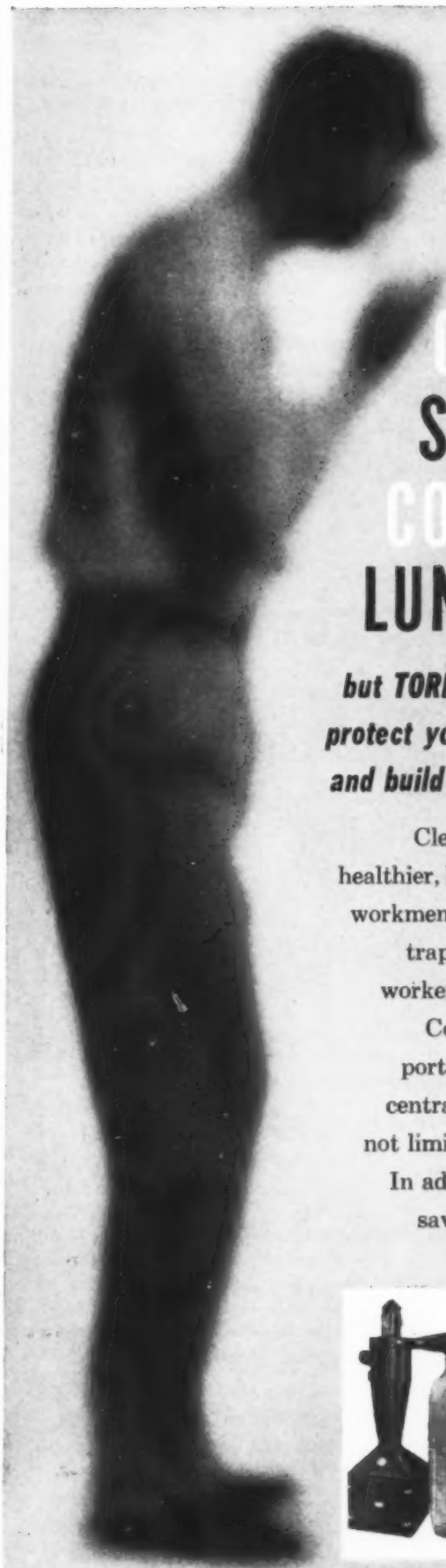
Gallmeyer & Livingston Company, Grand Rapids, Michigan.

Use postpaid card. Circle No. 40

New Tube Design Raises Dust Collection Efficiency

An improved integral dust collector with no filter to change is reported to handle high concentrations of dust, over a wide range of particle sizes, by using 2"-diameter tubes of new design installed in multiple to capacity required.

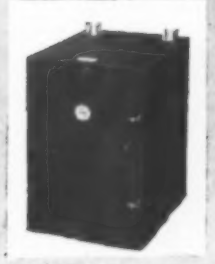
Developed to remove dust in grinding, buffing, polishing, milling and cutting operations, the new unit is said to provide high collection efficiency,



DUST
BURNS
EYES
CHAFES
SKIN
CONGESTS
LUNGS

but TORIT Dust Collectors protect your workmen and build good morale

Clean working areas make healthier, happier, *more productive* workmen. Torit Dust Collectors trap dust before it irritates workers. Unitized Torit Dust Collectors are completely portable—cost a fraction of central built-in units and are not limited to particular areas. In addition, Torit Collectors save heat by recirculating clean filtered air.



Free descriptive handbook describes all models and applications. Write today to . . .

TORIT MFG. CO. Department 508 311 Walnut Street Saint Paul 2, Minnesota

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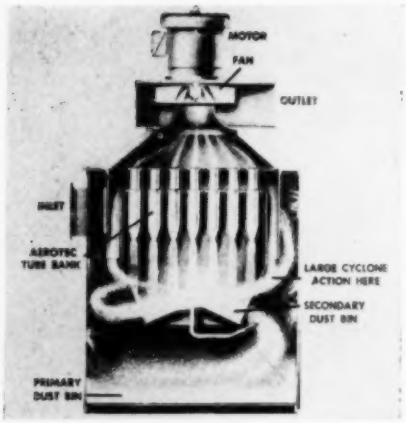


constant suction at hood and no fire hazard.

The new integral collector is available in seven standard sizes ranging from 300 to 2100 cfm capacity (shipping weight 300-1900 lbs). The manufacturer also builds special assemblies ranging from a single tube of 30 cfm to capacities of 50,000 cfm and larger. Single and multi-inlet adaptors and other accessories are available for this new integral unit.

Aerotec Industries, Inc., Greenwich, Connecticut.

Use postpaid card. Circle No. 41

Storage-Feeder Unit with Up to 12,000 Parts Capacity

A new storage-feeder unit with up to 12,000 parts capacity is designed to bank and/or feed parts in automatic parts handling installations. They maintain in-storage part orientation, first-in-first-out part sequence.

Standard units (floor or overhead suspended models) are comprised of from one to six storage decks which can be arranged to handle one or several different parts simultaneously. Each deck is a spiral track that can be wound into single or multiple part lanes.

Parts enter at the outer diameter of the deck, travel through the spiral

course to the center where they are discharged to the next lower deck or to processing.

Input storage and output feed rate is adjustable up to 6,000 parts per hour. Units are self-cleaning, with enclosure and drip pan available as optional features.

Frame construction is welded angle iron. Minimum floor space is equal to the square of the deck diameter, 40" to 72".

F. Jos. Lamb Co., Detroit, Mich.

Use postpaid card. Circle No. 42

Two-Sided Adhesive Film Holds Work for Grinding

Growing interest is reported for Double-Face® adhesive film as a means of holding non-ferrous metals on magnetic chucks for surface grinding operations.

Double-Face is a translucent pressure-sensitive mass in film form, supported by a protective release paper. By applying the film directly to the work, the operator can place each piece exactly where he wants it. The grinding surface is not limited.

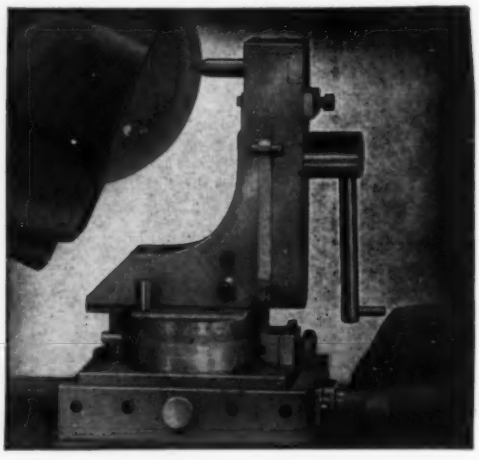
Adhesive qualities of the film are not affected by coolants. The non-cushioning effect of the thin film permits closer tolerances.

Tough Grinding Wheel Forms Dressed Easy as A, B, C

eliminate elaborate set-ups and operations

.0001" ACCURACY

Fluidmotion
WHEEL DRESSERS
dress two angles tangent to a radius in one continuous motion



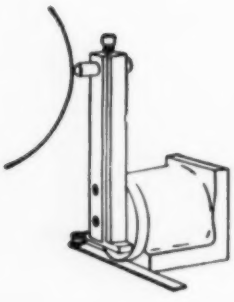
With the unique "Fluidmotion" Dresser, you can dress two angles tangent to a radius — using one handle in one continuous motion. Operation is so fast and simple that beginners can use them.

Adaptable to all type cylindrical and surface grinders.

A. Obtain micrometer reading; add required convex radius or subtract required concave radius.

B. Loosen jib with wrench and "mike" over lower pins to reading obtained above.

C. Tighten jib. Set stops for two angles. Ready for action.



Also available: "FORM MASTER" Dresser, capable of dressing any radii up to 12" convex, up to 15" concave.

See your industrial distributor or write for free literature.

J&S TOOL CO. INC. — CLAMPCUT

J & S TOOL CO., INC.
880 DORSA AVE.
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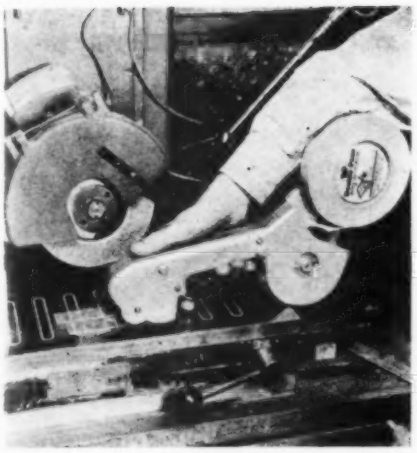


A portable applicator enables the operator to apply the film without touching it. Rolls up to 72 yards in length are available.

Interchemical Corporation, Finishes Division, Cambridge, Massachusetts.

Use postpaid card. Circle No. 43

New Binder Rounds Out Soft Rubber Abrasive Line

A new, semi-firm rubber cushioned abrasive binder known as Brightboy GB, just introduced, is said to round out a complete line of soft rubber abrasives for both metallic and non-metallic applications.

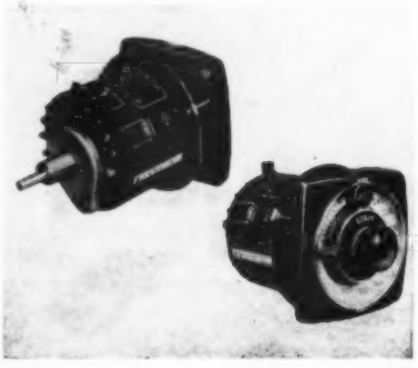
The line now includes four basic binders ranging from soft to tough. In each there are available six grain sizes from extra coarse to extra fine, and two grain types, aluminum oxide and silicon carbide. There is also Fine Tex, a compound of rubber and pumice abrasive. All items are in stock available for immediate delivery.

Brightboy Industrial Division, Weldon Roberts Rubber Co., Newark, N.J.

Use postpaid card. Circle No. 44

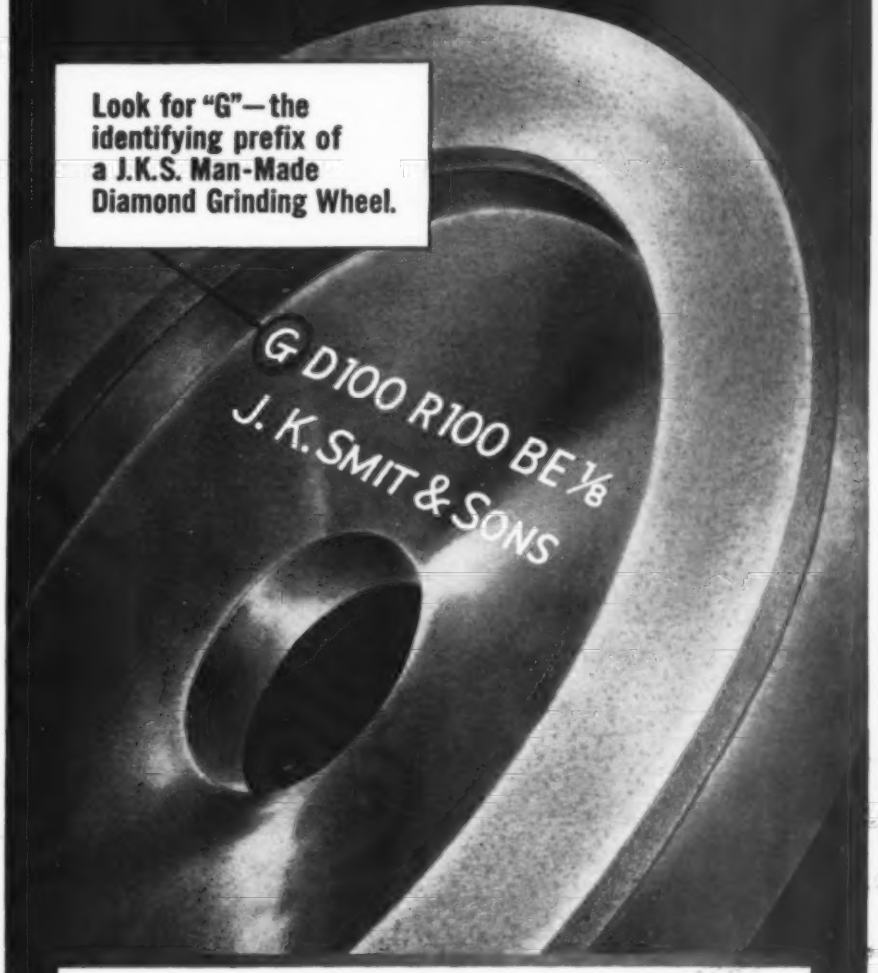
New Revolution Counter

A new miniaturized shaft-driven revolution counter counts shaft revolutions up to 100 rpm and requires only



The Beginning of a Revolution!

Look for "G"—the identifying prefix of a J.K.S. Man-Made Diamond Grinding Wheel.



J.K.S. Diamond Wheel Developments Slash Grinding Costs—Speed Production

Now, one of the world's most experienced manufacturers of diamond grinding wheels has brought its technical knowledge to the production of man-made diamond wheels.

The result is a revolutionary advance. Today's new J.K.S. man-made diamond wheels give longer life in many applications . . . speed up production on many difficult grinding jobs. Yet there is no extra cost . . . they are now priced the same as wheels made with natural diamonds.

In these wheels, too, you get a famous J.K.S. plus value: exact uniformity in wheel construction . . . duplicated in wheel after wheel . . . an advantage that results from special J.K.S. techniques and quality control.

NEW DIAMOND WHEEL CATALOG NO. 65

A necessary reference publication for everyone who buys or uses diamond grinding wheels . . . send today for Catalog, "J.K.S. Diamond Wheels, Saws and Hones."

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MURRAY HILL, NEW JERSEY

DETROIT, MICH.

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1¼ ounce-inch torque for dependable electrical control of a machine or system operation. Repeatability is ±0.0025 of dial range.

With its clutch energized by external momentary or sustained switch contact, the counter will indicate revolutions of a machine drive shaft until a predetermined dial setting is reached, tripping the heavy-duty SPDT control contacts. A totally-enclosed gear train reduces the number of input shaft revolutions to a single turn representing full scale of the dial.

Automatic Timing & Controls, Inc., King of Prussia, Pennsylvania.

Use postpaid card. Circle No. 45

Larger Electrically-Aided Grinder

Hammond's latest oscillating electrically-aided grinder, Model EG-10, uses a 10" wheel and has a 12" x 29" table, both larger than were available on any previous model.

Its enlarged capacity widens the scope of this method of carbide tool grinding. The effort of manual tool oscillation is eliminated by the oscillating spindle. Diamond wheel consumption is reduced 80% to 90%.

The table is 3" below the centerline of the wheel, can be tilted with a handwheel from 10° above to 22° below

horizontal with no movement toward the wheel. The table top can be lowered to provide 6" below the wheel centerline.

The spindle oscillates to tapered roller bearings, and has a variable stroke length of from 0 to 1½". The stroke frequency ranges from 0 to 100 per minute. The spindle assembly is insulated from the machine, has a 600 amp. capacity power pick-up.

Hammond Machinery Builders, Kalamazoo, Michigan.

Use postpaid card. Circle No. 46

Safety Spectacles

"Unispec Twins" safety spectacles are made to fit every face easily and comfortably. Two models cover five bridge sizes. Model 7446 fits 18, 20, and 22mm

bridge sizes. Model 7448 fits 22, 24 and 26mm bridge sizes, Each model, it will be noted fits a 22mm bridge size.

Glendale Optical Company, Valley Stream, New York.

Use postpaid card. Circle No. 47

"Do you know that a SPEEDLAP
removes material from a flat surface
faster than most grinders and
accurate within millionths of an inch?"
SPEEDLAP 18
Address SPEEDLAP CORPORATION
8022 N. Monticello Ave., Skokie, Ill.

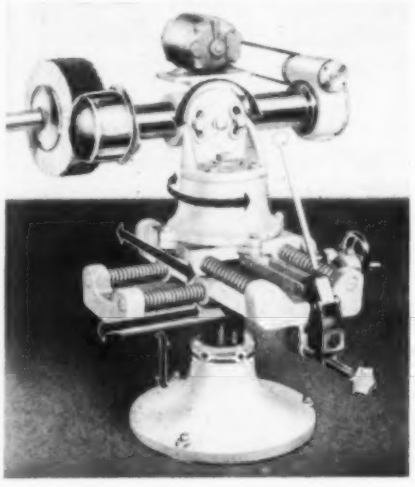
Use postpaid card. Circle No. 239

Versatile, Low-Cost Buffing and Polishing Machine

Versatile new equipment which will handle practically any buffing or grinding job in the average plant is now being produced.

The new machine, known as the Han-D-Matic, consists of a standard low cost basic pedestal and spindle unit with a wide selection of optional, interchangeable components which will accommodate practically any shape workpiece.

The Han-D-Matic is a quality built, heavy production type unit, specially



designed for use with the company's standard line of polishing equipment.

The Han-D-Matic is ideal for the smaller shop where its low capital outlay and inexpensive conversion for new jobs is an advantage. On the other hand, the large plant may own several of these versatile units with an assortment of standard components, affording them all the advantages of a dozen specially built machines, but with no obsolescence and at a small fraction of the cost.

Murray-Way Corporation, Birmingham, Michigan.

Use postpaid card. Circle No. 48

New Automatic Infeed Speeds Centerless Production

A new light-weight automatic "Lo-Die" centerless grinder infeed attachment is reported to offer precision grinding and duplicate sizing at a feed rate varying from 12 to 40 pieces per minute depending upon the tolerance and finish desired.

The attachment boasts a controlled grinding and dwell cycle that removes stock and holds finish constant.

Positive mechanical construction and drive from a ¼ hp, 220 volt, 3 phase

OSBORN®

BEFORE BRUSHING

AFTER BRUSHING

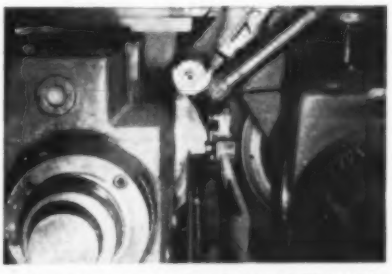
Precision brush finishing

. . . mass-production method

PRECISION parts by the thousands can be surface finished . . . at high, continuous rates. The method . . . Osborn Centerless Brushing . . . is fast, economical.

Cylindrical parts are fed past a revolving Osborn Matic® Brush. Surface finishes are refined to low microinch readings, grinding burrs are removed and surface junctures blended to reduce stress concentrations.

With Osborn Centerless Brushing, uniform quality of product is maintained. A wide variety of parts can be handled with the same basic brushing method.



CYLINDRICAL PARTS PRECISION FINISHED *automatically and economically with Osborn Matic® Brushes.*

Why not check what operations in your plant can be done at lower cost with power brushing. An **O**sborn **B**rushing **A**nalysis will show you how. There is no obligation, of course. Write today for details and for your copy of the new 100-page Osborn Catalog 210-D. *The Osborn Manufacturing Company, Dept. G-3, Cleveland 14, Ohio.*

Osborn Brushes

METAL FINISHING MACHINES . . . AND METHODS
INDUSTRIAL BRUSHES • FOUNDRY PRODUCTION MACHINERY

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CRAFTS

complete catalogue of DIAMOND DRESSERS for every need

Now ready for you—CRAFTS catalogue of diamond dressers for every need and use. Full prices, specifications and information about re-setting on the famous CRAFTS line. Information too about our inexpensive "Letter Series" of tools. CRAFTS continuous research and job testing provide you with more economical ways to increased production. Always dependable, CRAFTS service reduces costly delays — minimizes downtime.

Mail this coupon for your free Diamond Dresser catalog.

ARTHUR A. CRAFTS Company, Inc.

CRAFTS

601 NEWBURY STREET
BOSTON 15, MASS.
Dept. GF-59

NAME_____

TITLE_____

FIRM_____

ADDRESS_____

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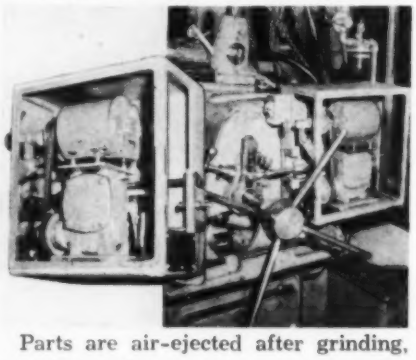
motor, the maker claims, do away with hydraulic drive action and eliminate the need to check oil levels and cylinders.



Parts are air-ejected after grinding, permitting the operator to devote his entire attention to loading.

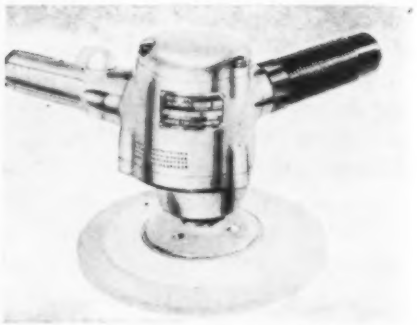
Lordstown Tool and Die Co., Inc., Warren, Ohio.

Use postpaid card. Circle No. 49

New Series of Air-Powered Vertical Sanders

High torque and lightweight construction have been combined in a new medium duty series (58S) of twenty-two vertical sanders.

Twelve of the twenty-two, equipped with governors, range from 1850 to 8500



rpm. Ten non-governed models have speeds ranging from 1500 to 7200 rpm.

None of the models weigh more than six pounds. All bear a spindle thread of $\frac{5}{8}$"-11 and have a fully adjustable dead handle.

Six models intended for operation at 7200 rpm and higher speeds use 5" pads; the others use 7" pads.

90-100 psi working air pressure and $\frac{3}{8}$" ID hose are recommended for maximum efficiency.

Governed models are priced at $260 each; non-governed, at $215.

Buckeye Tools Corp., Dayton, Ohio.

Use postpaid card. Circle No. 50

New Tool Analyser

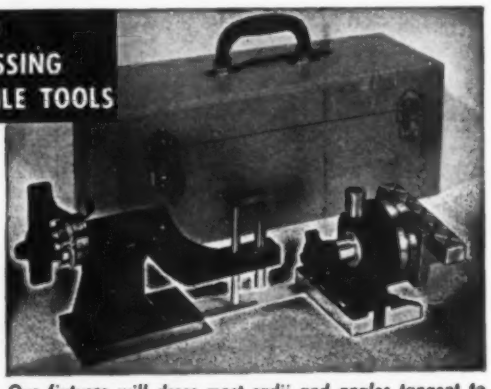
Increasing need for more accurate tool geometry has prompted Stocker & Yale, Inc. to bring out an improved version of their tap analyser.

The new model, designated as a tool analyser, accommodates many other

Now ANGLE TANGENT TO RADIUS WHEEL DRESSING WITH NEW VERSATILE TOOLS

MIGHTY GOOD AT ANY PRICE BUT TOPS AT ONLY $149.50
(Both tools including diamonds)

The G-5 RADIUS DRESSER is a precision engineered tool that will dress either a convex or a concave radius from .015" to 1.750" on a 7 inch or 10 inch wheel, and it may be set to the exact radii desired. Graduated stops allow you to dress any desired portion of a radius. The spring tension journal insures chatter free operation. The G-2 ANGLE DRESSER AND TOOL HOLDER is actually two tools in one, having an easy to read vernier scale 0° to 180° giving accuracy within 2" of 1°; an excellent time saver to set up small jobs to be milled, drilled, tapped, etc., on any desired angle.



Our fixtures will dress most radii and angles tangent to each other, similar to those shown below.

FREE handsome, wooden storage box. Write for complete information.

PURCHASE EITHER TOOL SEPARATELY

Now you can purchase either the G-5 Radius Dresser or the G-2 Angle Dresser and Tool Holder separately if you so desire. (Without storage boxes)

G-5 Radius Dresser complete with diamond $80.00.

G-2 Angle Dresser and Tool Holder complete with diamond $87.50.

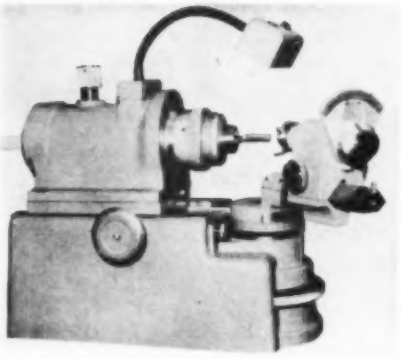
Replacement diamonds are always available for our units at a reduced price. Diamonds for the G-2 $5.00 each; diamonds for the G-5 $8.00 each.

Distributorship available in select territories

ROTHFUSS TOOL COMPANY

BOX 2696, ELMWOOD STATION PROVIDENCE 7, R. I.

Use postpaid card. Circle No. 242



small tools, including drills, reamers, end mills, broaches, hobs, etc.

The measuring principle incorporates a monocular, zero-parallax optical system with magnifications up to 40X. The tool to be inspected is accurately chucked in relation to index, view angle, and dimensional scales. Readings to .0001" may then be taken.

An important feature is that all readings are made at one setting, eliminating transfer errors. Shank tools are referenced on the shank in the identical manner in which the tool is used.

Stocker & Yale, Inc., Marblehead, Massachusetts.

Use postpaid card. Circle No. 51

New Low-Cost All-Purpose Filter

The Filtray, said to be a highly efficient, low cost, all purpose filter, uses a fabric (paper) as the filter medium. It handles all materials, magnetic or non-magnetic, as well as grinding wheel swarf and atmospheric dust and dirt. It is readily applicable to grinders, hones and diamond reclamation systems.

The tray is made of durable fiber glass which is impervious to all coolants and should last a lifetime. The effective area of the fabric is increased

by three heavy-gauge perforated metal screens acting to keep the fabric away from the tray walls, thus promoting faster flow of the coolant through the filter.

The unit is 5" high, 13½" wide, 22" long. Fabric changing takes less than a minute.

The unit is shipped set up ready to install, including a month's supply of coarse and medium fabric, for $64.50, fob, Rockford, Illinois.

Kebby Company, Rockford, Illinois.

Use postpaid card. Circle No. 52

Compact, Low Cost Barrel Finishing Machine

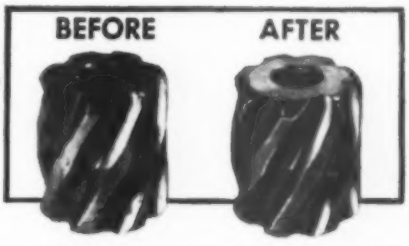
Shops doing deburring, radiusing and finishing of small parts can now obtain a low cost, automatic tumbling machine

newest method

ELLIOTT VIBRASLIDE BARREL FINISH EQUIPMENT

in barrel finishing!

3 hand operations were eliminated by the Vibraslide machine in finishing this 21 oz. steel pinion gear.



The Vibraslide Finisher's new Vibrating-Rotating action is bringing the best results yet achieved in barrel finishing . . . . faster, and at a fraction of previous costs.

Vibraslide finishes forgings, castings, machined parts and stampings up to four to eight times faster than other tumbling methods . . . . recessed areas and internal surfaces are smoother, more lustrous . . . . distortion, impingement damage, nicking and scratching are reduced to the minimum.

In two short years, Vibraslide machines have replaced or augmented barrel finishing equipment in some 80 leading industries. Try it yourself!

distributed by

metal finish, inc.

Call or Write for Demonstration

Bigelow 2-6211

410 Frelinghuysen Ave.
Newark, N. J.

Use postpaid card. Circle No. 243

Controls Tailor Made . . . from stock

Develop the control system you require from components that are available from stock!

This new system of machine tool control is now possible with *MICROtrol* °160, which offers 54 standard gaging and control components that can be combined to achieve any stage of automation in . . .

- *Grinding*
- *Boring*
- *Turning*
- *Milling*
- *Shaping*
- *Cutting*

MICROtrol 160 elements control the production cycle automatically. They inspect each piece, sort out rejects and tell the operator *when* and *how much correction* is required. Simple to install, and completely flexible, *MICROtrol* systems can be adapted to your production operation all at once . . . or in stages.

LET US SHOW YOU HOW

The *MICROtrol* System will improve your plant's production capability. One of our field engineers will survey your operation, tell you which *MICROtrol* elements you need.

°Trade Mark.

Contact your nearest Cutler-Hammer office or write to:

AIRBORNE INSTRUMENTS LABORATORY
DEER PARK, LONG ISLAND, NEW YORK
A DIVISION OF CUTLER-HAMMER, INC.

Use postpaid card. Circle No. 244

NEW EQUIPMENT *continued*

that's portable, economical, and ideal for close tolerance work. This is the new HANDEE Slide-Abrader, priced at approximately $200.

The simplified HANDEE tumbling operation is often said to pay for itself in just fifteen runs. Operator loads the machine, sets the automatic timer, flicks the switch. While the unattended HANDEE Slide-Abrader tumbles, finishing the parts, the operator is free for other tasks; the only labor involved is loading, unloading, and setting the HANDEE's timer.

Weighing only 64 lbs., with all steel construction, the HANDEE tumbling machine enables a plant or shop to set up its own precision barrel finishing facilities, in limited space at low cost, a minimum of labor, and practically no maintenance.

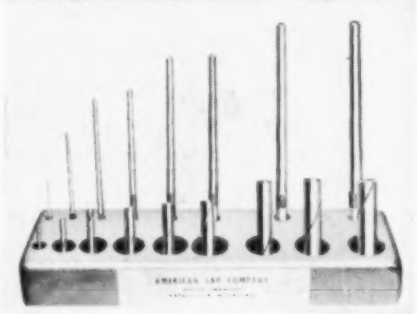
Chicago Wheel & Mfg. Company, Chicago, Illinois.

Use postpaid card. Circle No. 53

New Utility Lap Set

A new utility set of internal helical-slot expansion laps and their corresponding arbors, complete with a benchtop holder having individual retaining sockets for each tool and arbor, is now available.

Lap diameters for the nine laps range from ⅛-inch to ⅝-inch in increments



of 16ths a total of nine internal helical-slot laps. There are eight corresponding arbors for these commonly used lap sizes.

There is no additional charge for the benchtop holder. Laps and arbors are sold at catalog prices—the complete set of nine laps and eight arbors for a total price of less than $30.

American Lap Company, Detroit, Michigan.

Use postpaid card. Circle No. 54

there is a

STEVENS LIQUID TRIPOLI

for every buffing job!

HERE ARE THREE LEADERS:

27-L

COLORING COMPOSITION

A superior buffing compound for aluminum or any non-ferrous metal requiring extremely high color. Consistent, economical performance lowers costs, reduces rejects.

44-L

FASTEST-CUTTING TRIPOLI

Emulsion-type compound that sets record for pieces buffed per cwt. on all non-ferrous die castings, brass and aluminum.

59-L

ALL PURPOSE CUT AND COLOR TRIPOLI

Combines fast cutting characteristics with fine coloring qualities on all non-ferrous metals. Offers top total economy on the job.

Write for your copy of Stevens' new folder on liquid buffing and coloring compositions!

FREDERIC B. STEVENS INCORPORATED
DETROIT 16, MICHIGAN

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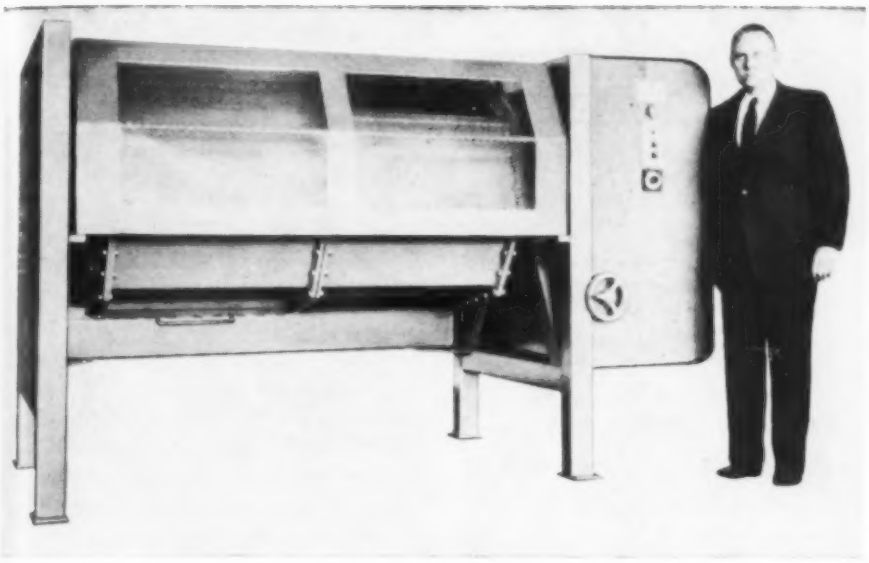

Barrel Finishing Machine with 40 Cu. Ft. Capacity

Capacity and precision control for large parts finishing, deburring, and polishing operations are features of the Rampe Model V36 barrel finishing machine.

The unit is offered in 36" x 48" and 36" x 64" barrel sizes with up to 40 cu. ft. total capacity. One- and two-compartment barrels are available to fit specific needs. Variable speed controls permit adjusting tumbling rates from 7 to 21 rpm.

Floating power drive, using an exclusive Rampe developed belt-and-gear power transmission system, provides smooth start-stop and quieter operation with reduced stress. Magnetic brake motor with remote control and overload protection is provided. A tachometer calibrated in barrel rpm can be furnished for precision work.

Rampe Manufacturing Co., Cleveland, Ohio.

Use postpaid card. Circle No. 55

"Good heavens, Ambrose . . . you mean we're completely out of them?"

Disturbing as it seems, people occasionally run out of Jewel Brand Abrasive Belts. Fortunately, they can replenish their supply quickly and easily through their nearby Industrial Distributor. Check *your* stock now!

JEWEL BRAND

COATED ABRASIVES

Belts • Rolls • Sheets • Discs • Specialties

ABRASIVE PRODUCTS, INC.

South Braintree 85, Massachusetts

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FOR FASTER GRINDING at LOWER COST

USE A.I.T. Diamond Wheels for all Carbide Grinding

RESIN **B-60** Cup Type Diamond Wheel

The exclusive B-60 Bond used in A.I.T. bonded diamond wheels has been field tested in over 400 plants. We can *prove* these superior advantages to you in YOUR plant:

- Faster grinding
- Up to 40% longer wheel life
- One grit size wheel can be used to hog and finish—for extra savings.
- Wheel grinds cooler—does not fracture carbide
- Corners stay sharper longer
- No re-dressing of diamond surface
- NEW BACKING dissipates heat faster
- No down-time for dressing inside body section

Write today for new, FREE catalog and prices

A.I.T. Diamond Tool Co.

8215 N. KIMBALL AVE.
SKOKIE, ILLINOIS

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ACCURACY .0002 T.I.R.

.0002 T.I.R. or less at Spindle Nose, .0005 T.I.R. or less on Test Arbor six inches from Spindle Nose

SPINDLE SPEEDS 150 and 250 RPM Other Spindle Speed Pulleys Available

MODEL B943 MOTOR DRIVEN WORK HEAD

No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost.

Clip ad to your letterhead and send for Literature

K. O. Lee Company, Aberdeen, S. D.

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"I just adore the strong, silent type!"

Because they feature exclusive *Velvet Joints* which permit a smooth, even flow of cutting surfaces, Jewel Brand Abrasive Belts eliminate needless "chatter" and jumping . . . last longer under continuous operation. Try some and see!

JEWEL BRAND

COATED ABRASIVES

Belts • Rolls • Sheets • Discs • Specialties

ABRASIVE PRODUCTS, INC.

South Braintree 85, Massachusetts

Use postpaid card. Circle No. 249

NEW EQUIPMENT *continued*

New Instrument Precisely Measures Temperature of Parts, Gage Blocks

A portable electrical instrument that measures the temperature of precision parts, gages, instruments, and machines and the surrounding air with respect to a reference temperature and which indicates minute temperature deviations on a meter, is now available.

Known as the "Teletemp" temperature measuring instrument, the new instrument measures the deviation of temperature at five separate points of inspection independently at the turn of a dial. Deviation at each temperature detection point is read on an indicating meter as plus or minus from one tenth to one fortieth of a degree.

The temperature indicating meter has three temperature amplifications and ranges, operator selective, to permit fine, medium and coarse temperature variations to be measured.

The Sheffield Corporation, Dayton, O.

Use postpaid card. Circle No. 56

New Heavy Duty Surface Grinder

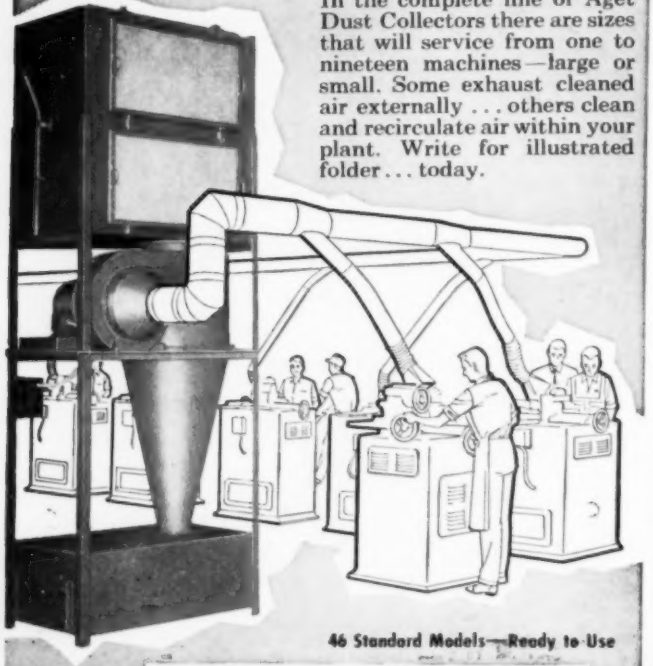
The Sf-20 long surface and slideway grinder is designed to meet the increasingly heavy demand for a machine capable of handling long surface grinding jobs and heavy duty work beyond the capacity of smaller ELB surface grinders.

Simplicity of design and economical manufacturing methods are said to have permitted a price below the previous

just ONE DUSTKOP STOPS DUST

heavy duty unit services up to 19 MACHINES

In the complete line of Aget Dust Collectors there are sizes that will service from one to nineteen machines—large or small. Some exhaust cleaned air externally . . . others clean and recirculate air within your plant. Write for illustrated folder . . . today.



46 Standard Models—Ready to Use

AGET manufacturing company

1380 Church Street • Adrian, Michigan

Use postpaid card. Circle No. 250

New RAMPE 30 x 48

cuts big-job finishing costs

Real cost-saving is only part of the story with this newest, most productive Rampe machine. In 30 x 32 or 30 x 48 sizes, with one to three compartments, it gives you broad usefulness, simple operation, and the rugged dependability recognized in all Rampe precision finishers. Variable speed drive 8 to 25 rpm, "No-Seam" vinyl-lined barrels, and a wide selection of control accessories give real flexibility. Find out how you can cut costs . . .

write for details on Model 30x32 or 30x48 today.

RAMPE MFG. CO.

14915 WOODWORTH AVE., CLEVELAND 10, OHIO

Use postpaid card. Circle No. 251

"Egads, sir . . . there's been nothing like 'em since the Flora Dora girls!"

Few performances can match the superlative grinding, smoothing, and polishing action of Jewel Brand Abrasive Belts. A trial run proves it! Order through your Industrial Distributor today.

JEWEL BRAND

COATED ABRASIVES

Belts • Rolls • Sheets • Discs • Specialties

ABRASIVE PRODUCTS, INC.

South Braintree 85, Massachusetts

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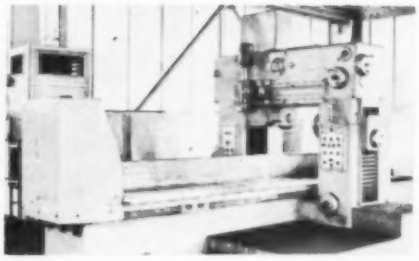

level, and within the range of middle-sized shops.

Aaron Machinery Co., Inc., New York, New York.

Use postpaid card. Circle No. 57

Visitor's Safety Glasses

Inexpensive, light weight, but effective industrial eye protection that can be worn all day with ease and comfort, even over regular glasses, are features of the new VS3 Visitor Spec.

The new Spec weighs less than an ounce. The wide brow rest and .080" thick lens are of unit construction.

Wilson VS3 Visitor Specs come in either green or clear lens and are equipped with library type temples, universal fitting for any head.

Willson Products Division, Reading, Pennsylvania.

Use postpaid card. Circle No. 58

SEND FOR CATALOG G

NAME

TITLE

COMPANY

STREET

CITY/STATE

DRESS SNAGGING WHEELS:

CUT COSTS

Coarse snagging wheels grind faster, last far longer when dressed regularly with a Desmond Heavy Duty dresser. Even on high-speed resinoid and rubber bonded wheels inexpensive Desmond mechanical dressers expose new, sharp grains and provide a fresh, unloaded surface. Desmond Hex and Huntington dressers are widely used on large and medium size vitrified and silicate wheels. Desmond dressers soon pay for themselves.

The only complete line of grinding wheel dressers and cutters

Desmond

Desmond-Stephan Mfg. Co.

Urbana, Ohio

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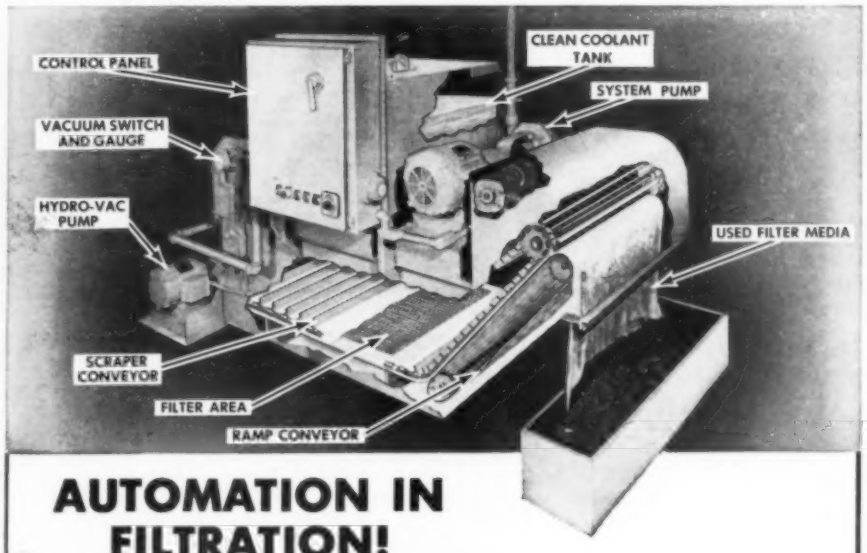


AUTOMATION IN FILTRATION!

- Completely automatic operation
- Used with individual machines
- Compact — with low liquid inlet
- Low operating cost
- Fine degree of filtration
- Pressure and vacuum forces act on filter media
- Any coolant — any sludge

HYDROMATION FILTER CO.

19661 Schoolcraft Detroit 23, Michigan VErmont 8-0492

Use postpaid card. Circle No. 252

Here's the quick, low-cost way to get any Controlled Surface Finish

Are you paying more than necessary to obtain *controlled surface finishes?* You probably are if Gisholt Superfinishing is new to you. You are losing time, money and paying a premium for quality as well, on many jobs.

With Superfinish you preselect the surface finish you need—as high as 80 or as low as 1 micro-inch RMS—and you get it faster, at less cost than by any other method. Rather than an expensive extra step, Gisholt Superfinishing actually eliminates tedious, more costly processes.

Not only do you save time and money, but you get a "controlled" surface finish, free of smear metal—with the true base metal exposed—one that provides greater area contact for heavier loads and longer life in your specific application.

Whether your job requires a 1, 20 or 80 micro-inch finish, setup is fast and easy. Nothing is left to the operator's skill or judgment. Stone pressure and grade, and reciprocation rate are preselected to produce the finish you require, for job lots or large production runs.

It will pay you to find out how Gisholt Superfinish can cut costs, improve quality and lengthen service life on your standard or problem parts. Ask your Gisholt Representative or write for Bulletin 1169.

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

Investigate Gisholt's Extended Payment and Leasing Plans

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes • *Factory-Rebuilt Machines with New-Machine Guarantee*

Use postpaid card. Circle No. 254

News from the Industry

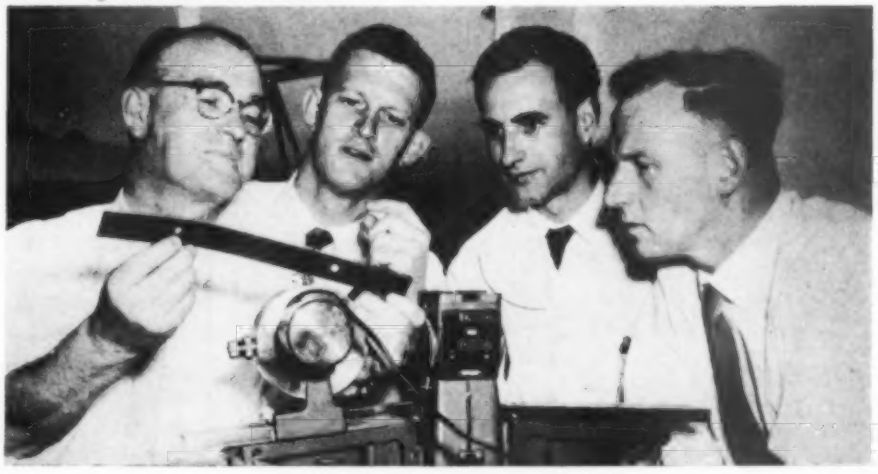
De Beers Announces Lab Production of Synthetic Diamonds

The South African laboratories of the De Beers Consolidated Mines has announced that they are now manufacturing a synthetic industrial diamond. The announcement is the climax to a program initiated in 1955.

The first step undertaken by the research group was the design and construction of a pressure chamber which could withstand pressure and contain temperatures at the high levels necessary for diamond synthesis.

Experiments on such a chamber began in May, 1957, and continued for more than a year. In September, 1958, the conditions necessary were attained and the first synthetic diamond was produced.

The first particle of synthetic diamond produced in South Africa measured 0.4 mm by 0.25 mm, and it was made up of 6 equal-sized particles closely cemented together.



The four principal scientists who have successfully perfected a method of manufacturing synthetic diamond material examine an X-ray negative proving the authenticity of their achievement, at the Adamant Laboratory of De Beers Consolidated Mines in Johannesburg. The scientists are, left to right: Dr. J. F. H. Custers, director of research, Dr. B. W. Senior, Dr. P. T. Wedephol and Dr. H. B. Dyer.

The pressure chamber design was improved to yield consistent results and to maintain the critical condition of pressure and heat required for synthesis. During the past year thousands of experiments to find the best starting material (catalyst) were carried out until, on September 16, 1959, continuous laboratory production was established.

The diamonds made in the Adamant Laboratory consist in effect of an abrasive grit suitable for use in resinoid-bonded grinding wheels. According to H. F. Oppenheimer, Chairman, De Beers Consolidated Mines, Ltd., "It is only in this field that synthetic diamonds have so far been able to compete. The Adamant Laboratory has not been able to manufacture other types of industrial diamonds, and there is no question of the manufacture of gem diamonds.

"The whole manufacturing process is still in the laboratory stage, but we are confident that it would be technically and economically possible for us to proceed to manufacture on a commercial scale if we found it desirable to do so."

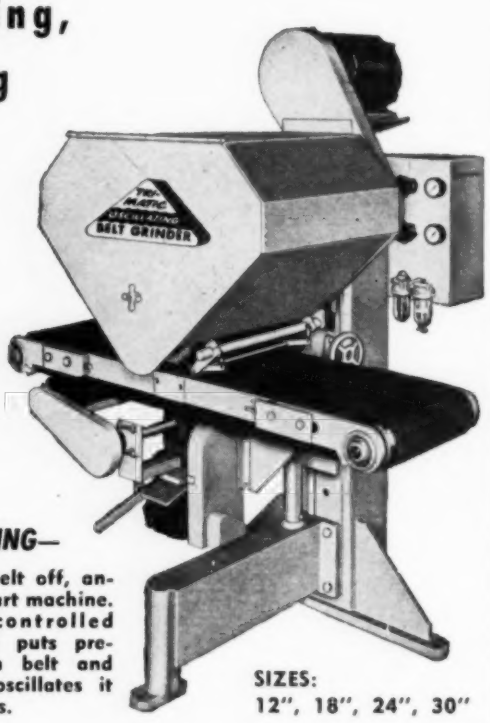
These X-ray diagrams of a natural diamond (below) and of a De Beers synthetic diamond (above), respectively, both being single crystals, were made photographically using a special camera. The X-ray diffraction spots are seen to be arranged in circular arcs; the arcs on the higher diagram are identical with those on the lower diagram. These photographs or diagrams are like fingerprints which exclude all doubt as to the exact nature of the product.

Jeppson, Higgins Re-elected

George N. Jeppson, marking his 68th year with Norton Company, was re-elected chairman of the board and **Milton P. Higgins** was re-elected president at the company's 75th annual meeting at Worcester, Mass.

NEW TRI-MATIC *Oscillating* BELT GRINDER

Change Belts in Seconds for Deburring, Descaling, Grinding, Polishing, Buffing



Automatic BELT TRACKING—

Just slip one belt off, another on and start machine. Aer-tronically controlled belt oscillation puts pre-set tension on belt and automatically oscillates it to pre-set limits.

SIZES: 12", 18", 24", 30"

FASTER, CLEANER CUTTING results from the shearing action imparted by the oscillating belt. Rate and traverse of oscillation is variable.

UNMATCHED VERSATILITY is obtained through these variables:

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- Capacity under contact wheel 0" to 5".
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- Belts from 6" width to full width can be used to fit job requirements.
- Fixtured conveyor easily arranged for shaped pieces.
- Wet conveyor table available for wet operations.

Practical abrasives engineers will study your problem and give you their recommendations without obligation. Send complete details and material for actual test if possible. For complete details ask your TRI-MATIC Distributors or write for illustrated, detailed Bulletin TM 459. TODAY.

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Sales Service Mfg. Co.

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NEW EQUIPMENT *continued*

Ralph M. Johnson officially retired as a vice president and director of Norton Co. He had retired as director of sales about a year ago.

Also retiring is **Frank M. Ryan,** vice president and general manager of Norton International Inc., Norton's export division, after more than 46 years with the company.

Dr. Wilfrid F. L. Place succeeds Mr. Ryan as vice president and general manager of Norton International Inc.

Personnel Changes

P. O. Peterson has been elected president and a director of Hercules Motor Corporation, Canton, Ohio.

Dr. E. G. Fubini and **Dr. C. G. Comstock** have been appointed vice presidents of Airborne Instruments Laboratory, Deer Park, N.Y.

George W. Steinmetz is named manager of industrial distribution for Pratt & Whitney Company, Incorporated, West Hartford, Conn. This is one of the first steps toward selling cutting tools and conventional gages through selected industrial distributors.

At Norton Company, Worcester, Mass., **Malcolm M. Maynes** becomes chief sales engineer of abrasives, and **William S. Elliott** moves up to supervisor, product utility section, sales engineering.

Edward T. Moore is now representing Vitrified Wheel Company, Westfield, Mass., in the Pittsburgh, Pa., area.

Lawrence Almeida joins The Chicago Rubber Co., Waukegan, Illinois, as plant manager and chemist.

Robert W. Gossard and **Herbert J. Niemann** have been named managers of Pangborn Corporation's newly-formed Milwaukee and Indianapolis districts. **J. Donald FitzGerald** moves from Copperweld Steel to Pangborn as an abrasive sales engineer in Cleveland, and **Gaylon D. Robinson** joins the company in a similar capacity in Chicago.

W. E. Sanders has been appointed sales and service representative for the N. A. Woodworth Company, Detroit, Michigan, in the southern Illinois and eastern Missouri area.

G. N. Jeppson

M. P. Higgins

F. M. Ryan

W. F. L. Place

P. O. Peterson

E. T. Moore

L. Almeida

W. E. Sanders

W. A. Kowalske

W. W. Marshall

John Cadigan

A. N. Beswick

Donald E. Cox has been promoted to Pacific Coast regional sales manager, Coated Abrasives Division, Armour Alliance Industries, Alliance, Ohio, replacing **William T. Loeck,** retired.

The Gisholt Machine Company, Madison, Wisconsin, has transferred **Walter A. Kowalske** to San Francisco, California, as direct sales representative.

Appointments of **Frederick J. Pichard** as assistant director of marketing and **Donald A. Swardson** as manager of abrasive and Long-Lyfe parts sales at Wheelabrator Corporation, Mishawaka, Indiana, were recently announced, together with the naming of **William Butler, III,** as administrative assistant to the president.

Ronald W. Greiner and **Gerald L. Swartz** have joined American Buff Company as salesmen in the southeastern Michigan and the New England areas, respectively.

At Rivett Lathe & Grinder, Inc., **Thorwald S. Ross, Jr.,** is vice president in charge of manufacturing; **Walter C. Woodworth** moves up to production and procurement manager; and **William R. Wright** is purchasing agent.

Edward J. Grant has been appointed general manager and acting head of the service products division, S. C. Johnson & Son, Inc., Racine, Wisconsin.

Firth Sterling, Inc., Pittsburgh, Pa., has named **Fenton Tomlinson, Jr.,** to its West Coast sales staff, and **Thomas R. Quay** to a similar post in the Minneapolis, Minnesota, area.

New appointments for the Pacific Region of Allis-Chalmers Industries Group, Milwaukee, Wisconsin, are the following: **J. A. Longley,** regional representative for transmission and distribution equipment; **T. E. Meyers,** manager, San Francisco; and **G. K. Lewis,** manager, Portland.

William W. Marshall and **John Cadigan** have been named district sales managers in the Eastern and East-Central regions, respectively, for Rockwell Manufacturing Company's Delta Power Tool Division.

Appointments of **Albert N. Beswick** and **William B. Likens** as sales engineers for Bendix Filter Division, Bendix Aviation Corporation, Madison Heights, Mich., have recently been announced.

Ray A. Young has been named general sales manager of Seneca Falls Machine Co., Seneca Falls, N.Y.

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DRILL HARDEST MATERIALS KNOWN for accurate, high-speed production of glass, marble, ceramics, tungsten carbide and similar products. Hoffman Bits produce efficient coring and finish grinding results at operational speeds to meet requirements of most advanced production equipment.

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Rowe Becomes Exolon's Manager, Product Development

R. G. Rowe has been named as manager, product development, with The Exolon Company, Tonawanda, New York, effective January 1, 1960. He was formerly a supervising engineer in Carborundum's Research and Development Division.

R. G. Rowe

W. E. Brandt

Pangborn Forms Vibratory Finishing Division

Pangborn Corporation, Hagerstown, Maryland, has announced the establishment of a new Vibratory Finishing Division.

The new division, located at the company's Hagerstown headquarters, is headed by **William E. Brandt** as manager. Pangborn is now marketing a full line of precision barrel finishing and vibratory finishing media and compounds, and will soon announce a new line of finishing machines.

Chief Field Engineer Appointed

Wesley F. Payne has been appointed Chief Field Engineer in the Tri-Matic Oscillating Abrasive Belt Grinder division of Sales Service Mfg. Co., St. Paul, Minnesota, according to George F. Booth, Executive Vice President.

Carborundum Sales Appointments

Gordon O. Watson, formerly assistant director of marketing for Carborundum's Midwestern sales district, has been named assistant director of marketing for the company, in Niagara Falls, N.Y.

In the Bonded Abrasives Division, **D. H. Currie** becomes field sales engineer in Buffalo; **A. E. Bennett** assumes like responsibilities in Detroit; and **P. R. Thomas** moves to Niagara Falls as product manager for vitrified products—metallic applications.

H. B. Jorgensen also has been transferred from Chicago to Niagara Falls as division supervisor, sales training.

Other changes are the following: **M. F. Jenkins,** to field sales engineer, central Indiana; **H. Porth,** to salesman, Indianapolis, Indiana; **R. R. Kerrigan,** to salesman, Rockford, Ill.

Also **P. R. Junod,** to district sales manager, Philadelphia; **K. W. Martin,** to salesman, Syracuse; and **M. W. Spiller,** to salesman, Buffalo.

Also **J. H. Jones,** to general salesman, Arizona; and **G. S. Schroyer,** to salesman, Salt Lake City.

G. O. Watson

R. A. Green

New Detroit Manager Appointed by Bay State Abrasives

Robert A. Green, abra ive specialist for Bay State Abrasive Products Company, Westboro, Massachusetts, was promoted to be Detroit district manager, effective February 1. Mr. Green replaces **S. Gordon Saunders,** who remains with the company.

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New Distributors, Reps.

Following is a list of newly-appointed distributors and sales representatives:

Motch and Merryweather Machinery Company, 23520 Woodward Ave., Detroit 20, Mich., covering eastern Michigan and northwestern Ohio for the **Oliver Instrument Company, Inc.,** of Adrian, Michigan.

Allied Products Division of The Motch and **Merryweather Machinery Company, 875 Greentree Road, Pittsburgh and 1250 East 222nd Street, Cleveland,** covering eastern Ohio, western Pennsylvania and West Virginia for **The Taft-Peirce Manufacturing Co.,** Small Tool and Gage Divisions.

Manufacturer's Service, Inc., 2210 Chico Ave., El Monte, Calif., covering southern California and Arizona for **Mecha-Finish Corp.,** Sturgis, Michigan.

For the **J. T. Slocomb Company,** South Glastonbury, Conn.:
R. A. Heller Company, 5609 Vine Street, Cincinnati 16, Ohio, and John B. Lyons and Associates, 2771 DeLowe Drive, East Point, Georgia, covering the southern states.

For **Tumb-L-Matic, Inc.,** Stamford, Connecticut: Thomson and Willett Co., Haverford, Pa., covering eastern Pennsylvania, southern New Jersey, Delaware, and Maryland. Joseph Upton, Jr., New York City, covering metropolitan New York, northern New Jersey, and the lower Hudson Valley.

For **Alloy Metal Abrasive Company,** Ann Arbor, Michigan: Sierra Foundry Supply, San Gabriel, Calif., covering California.

For **B. C. Ames Co.,** Waltham, Mass.: Paton and Meegan, 138 Silver Lane, East Hartford, Conn., covering the state of Connecticut.

Heald Opens Milwaukee Office

The Heald Machine Company, Worcester, Mass., has opened a new sales office in Milwaukee, Wisconsin, its fourth since August, 1959.

The new office, operating as part of the Chicago branch, will be directed by **William A. Green,** formerly sales engineer at Detroit.

Other promotions include the appointment of **Joseph W. Whitaker** to be assistant manager at Chicago; **Russell H. Grant** to be field representative at Detroit, succeeding Mr. Green; and **Russell E. Lane,** transferred from Worcester to be a sales engineer at Detroit.

W. A. Green

J. W. Whitaker

R. H. Grant

3M Moves High Point Office

Operations of the High Point sales branch of Minnesota Mining and Manufacturing Co. of St. Paul, Minnesota, have been moved to 3M's newly-completed building at 2401 Brevard Street, Drake Industrial park, in southwest High Point.

Former quarters were in leased space at 1501 South Main Street, High Point.

The new building includes 12,000 square feet of air conditioned offices and 33,000 square feet of warehouse space, together with a railroad spur and a loading dock for six trucks.

HEAVY DUTY GRINDER SHARPENS METAL CUTTING SAWS TO 84" DIA.

For large Diameter Saws of all types, Inserted tooth, Segmental or solid tooth. Adjustable to wide variety of tooth spacings. Extremely heavy duty Construction Ball and Roller bearing throughout. Saw teeth generated by cam control. Adjustable by means of conveniently placed hand wheels to wide range of tooth spacings and depth of saw teeth. Saw is carried on heavy duty roller bearings for greater accuracy and fine finish.

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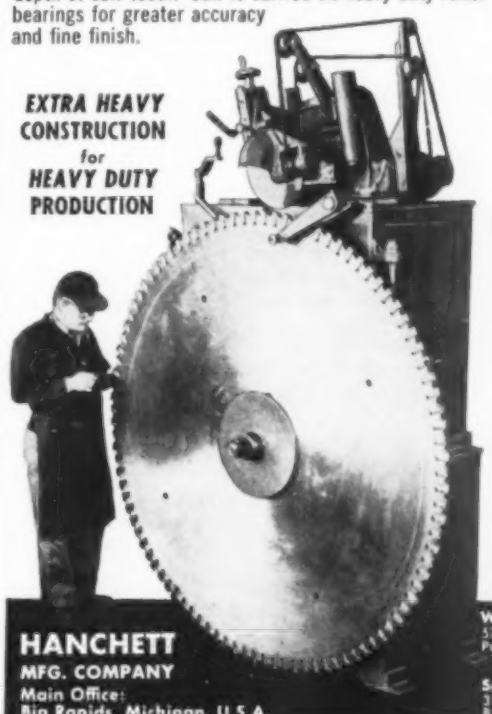

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South:
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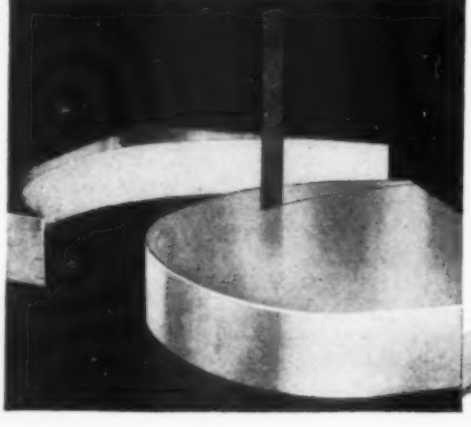

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NOW AVAILABLE – diamond saws especially designed for cut-off and machining of reinforced plastics. Precision cut-off wheels for semi-conductor production – made in Thicknesses down to .004"

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Schaffner Adds Facilities

Schaffner Mfg. Co., Inc., Pittsburgh, Pennsylvania, has announced the addition of 25,000 square feet of floor space to the firm's manufacturing facilities.

Ohio Seamless Tube Plans $3 Million Expansion in 1960

An extensive program to expand manufacturing facilities at the Ohio Seamless Tube Division of Copperweld Steel Company, Shelby, Ohio, has recently been announced. During 1960, approximately $3 million will be expended for new equipment and the revamping of present facilities.

Black & Decker Appointments

A number of appointments in engineering, research and development at Black & Decker, Towson, Maryland have recently been announced.

John L. Bennett becomes product development manager; **Robert H. Riley, Jr.**, has been named technical services manager in the engineering department; and **Samuel H. Kohler** has been appointed product development supervisor in the same area.

William S. Brucker has been appointed engineering manager of the Master Power Corp., a Black & Decker subsidiary at Bedford, Ohio.

R. Marriott

Barnes Drill Co. Elects New Officers

Roger Marriott has been elected president and general manager of Barnes Drill Co., Rockford, Ill., with **Harold A. Johnson** as executive vice president and **Charles Birks** as secretary-treasurer.

Prior to the election, **A. M. Johnson**, president of the company, announced his retirement after 52 years with the company. He will, however, continue to serve as a director and consulting engineer with the organization.

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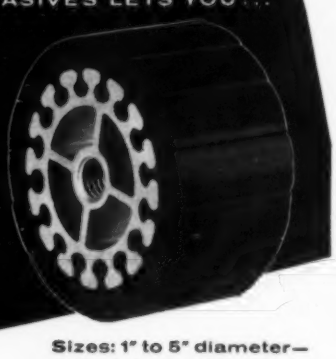
CUT GRINDING/ FINISHING/ POLISHING/ COSTS 3 WAYS!



Sizes: 1" to 5" diameter— others on special order.

Flexcore expanding wheels provide triple savings by:

*1. **Reducing abrasive costs up to 33%*** — Expanding rubber flexers prevent band "walk off" . . . end abrasive waste . . . permit full use of each band.

*2. **Eliminating wheel replacement costs**—* Permanent metal core is never scrapped . . . low-cost rubber flexers are easy to replace.

*3. **Speeding production—Flexcore*** puts all your abrasive to work for you . . . more output per time and money invested . . . no time-consuming maintenance.

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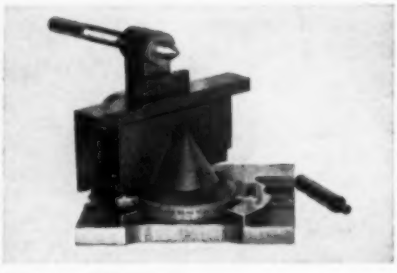

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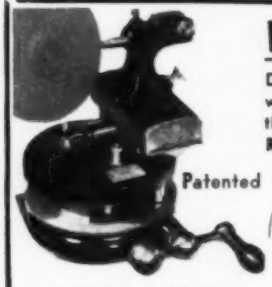

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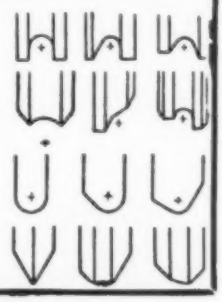

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Predict Top Metals Exposition

High interest is being demonstrated throughout the United States in the 2nd Southwestern Metal Exposition and Congress May 9-13 in Dallas, reports **Allan Ray Putnam**, managing director, American Society for Metals.

This is evidenced, he states, by inquiries on the display of basic materials, machinery for fabricating and testing, and methods to improve production at reduced outlay.

All exhibit areas are expected to be filled. Eight one-half day technical sessions with authoritative speakers are expected to attract a heavy attendance both from the Dallas area and from other parts of the United States.

Code of Ethics Adopted

What is believed to be the first attempt at an industry-wide code of ethics and trade practices was recently ratified by the board of directors of the National Association of Metal Finishers.

The code involved nearly two years of research and study by the NAMF ethical and standard practices committee under the leadership of **John T. Hyduke** of Durable Plating Company, Cleveland.

"Mr. Fred" Van Norman (center) one of the founders and former board chairman of the Van Norman Company, receives congratulations on his 97th birthday from Paul W. Leming, president, (left) and Selby F. Greer, executive vice president (right), both of Van Norman Machine Co. Mr. Van Norman is in his 75th year with the company.

Grinding Wheel and Abrasive Developments Feature Exposition

Grinding wheel, abrasive, and cleaning developments, including a wide variety of hand tools, are expected to be a major focus of interest at the 1960 Castings Congress & Exposition, Philadelphia, May 9-13.

Already scheduled for exhibits are Electro Refractories & Abrasives Corp.; Fox Grinders, Inc.; Simplicity Engineering Co.; Master Power Corp.; Thor Power Tool Co.; Wheelabrator Corp.; Carborundum Co.; A. I. C. Engineering Co., Inc.; Tabor Mfg. Co.; Pangborn Corp.; Standard Electrical Tool Co.; Alloy Metal Abrasive Co.; Pittsburgh Crushed Steel Co.; and National Metal Abrasive Co.

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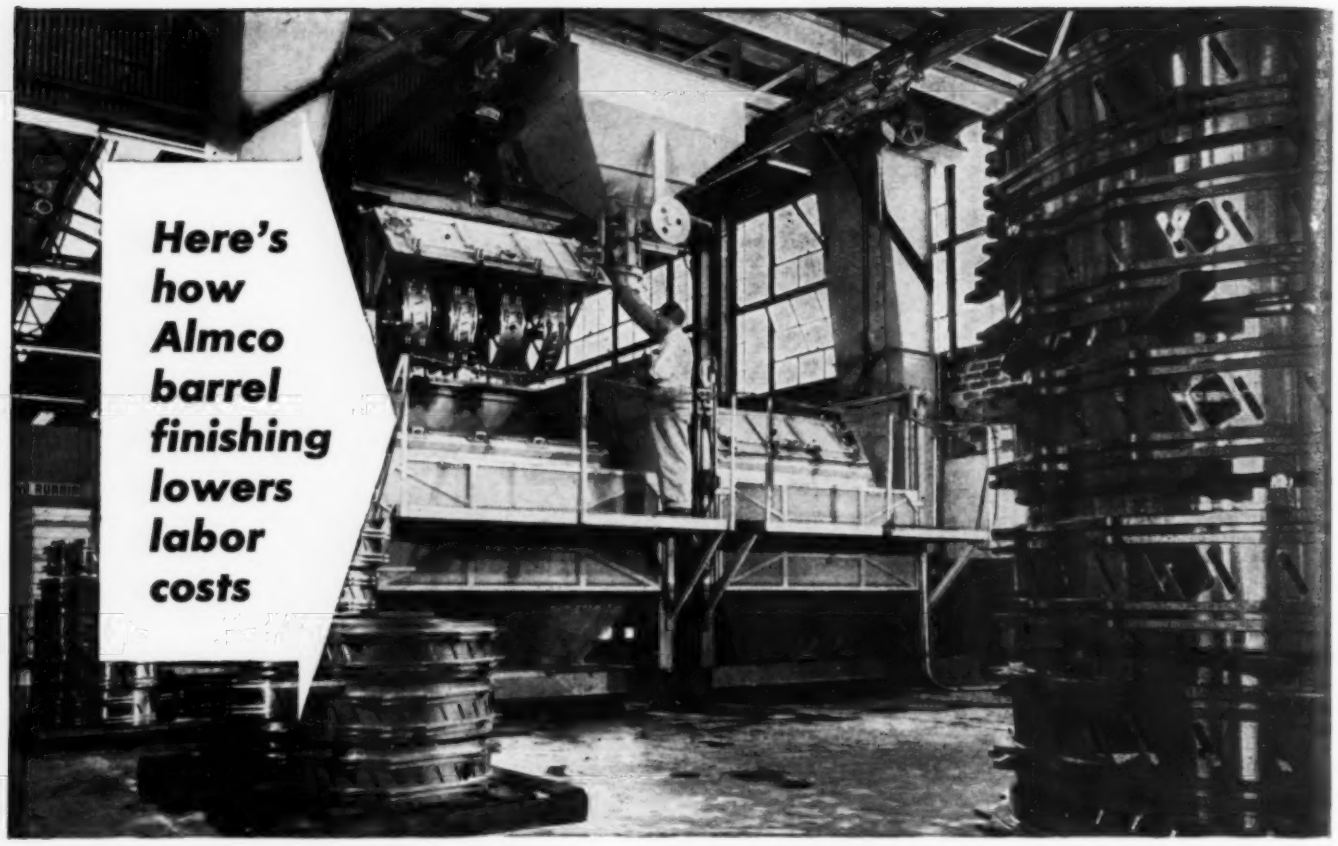

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Fast, precise barrel finishing is a vital key to production of intermediate jet engine parts shown above. Made by Rheem Manufacturing Co., Downey, California, these forged and machined jet engine flanges are cleaned and deburred in custom designed ALMCO barrel finishing equipment prior to welding operations.

Four of the circular units are locked onto a fixture within the equipment. From a pit below, deburring and polishing materials are transferred *automatically* to an overhead hopper for recharging the barrel after work is in place.

In one hour, burrs are removed from all four parts and surfaces are thoroughly cleaned and polished. A preservative coating is also applied to the units at the end of the barrel finishing cycle.

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Manually, this deburring and cleaning work formerly required *six hours per unit!* Uniform processing of all projections and surfaces was difficult if not impossible!

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GRINDING and FINISHING

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30 Machines—No Money Down and Tax Deductible

Special report on a new and comprehensive plan for leasing machine tools, permitting the replacement of obsolete equipment and the expansion of productive facilities without capital outlays.

34 Grinding for Maximum Life, Minimum Maintenance

Buyers of refrigerators demand appliances that will last forever, never require service. A case study of Whirlpool's answer to this challenge.

36 The Care and Use of Diamond Tools

Ten tested Tips to help you get better performance and longer life out of your diamond tools.

37 Two Rough for One Finish at Ford

Two roughing lines feed one finishing line in a fully-automated sheet polishing operation. Permits required stock removal without delaying the finishing procedure.

39 Centrifugal Separator Ups Diamond Wheel Life

Cleaning ground glass from coolant saves one $3,000 set of diamond grinding wheels per year, one day of machine downtime per month.

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Comprehensive discussion of machines for honing.

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Application of standards techniques to oscillating-type cylindrical grinders and the development of the multi-variable chart for job-shop operations.

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Mechanical Billet Snagging
Exclusive report on the latest in mechancial snaggers—an automatic billet grinder with a fixed wheel head that automatically grinds all four sides of a billet.

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The third part of this series covers honing tools, abrasives, and coolants.

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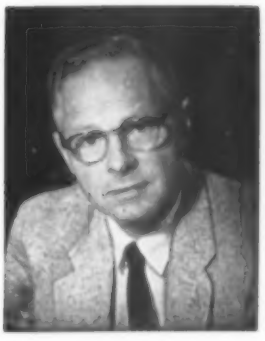
A Final Thought

The Happiness Binge



One phrase became the trade-mark of the great entertainer, Ted Lewis, "Is everybody happy?" Inasmuch as it is any entertainer's job to spread happiness, the phrase was apt. However, somewhere along the line, aided and abetted by well-meaning social scientists, personnel managers, enlightened managers and management consultants, the question leaped from the stage into the factory, where it became the answer to all labor and production problems. "The happy worker is a good worker," was the new philosophy and management went all out on a happiness binge and tried to form a happy family, and even, in some instances, administered it paternalistically. Employee activities were organized, recreation rooms built, housekeeping and safety measures strengthened, managerial and supervisory attitudes tampered with, picnics, internal magazines and coffee breaks were introduced, insurance and retirement plans, and in some places, profit sharing plans were launched—all in an effort to make an employee happy.

And let us not say this has been wasted nobility and good money thrown down the drain after good intention. As a result of all this we live in a changed, and a better industrial world.

Yet, today, management's happy smile is slightly strained and the corners of the mouth are pulled down ever so little. There is doubt of the soundness of the basic premise that "a happy worker is a good worker." While many companies embraced this premise only because they saw in it a scheme to get more work without giving in return, others fell in with it because they experienced, after the war, a moral awakening (lacking in management during the twenties) to their social obligations which this new philosophy so nobly expressed.

What is wrong with this philosophy?

A person does not expect to be happy at work, nor must it be assumed that he would like to be. He works because he must; work is as inescapable as death and taxes. Those things which mean true happiness to a person are generally found outside of the factory or office, in other activities. He works only to be able to participate in these after-hour pursuits. Management cannot persuade workers to be happy at machines or desks regardless of coffee breaks, picnics, insurance, etc. Management can, to be sure, make work more tolerable, more agreeable, but the very idea that he, the worker, is about to be happy, or that measures are being instigated to surround him with bliss and joy, is not particularly appealing to him. It just isn't what he wants!

One of the basic needs to the worker (aside from wages), whether in office or plant, is Professional Recognition from his superior. He wants to be part of a group, a recognizable segment of a large whole and not merely an expendable cog who must be kept happy with a picnic. He wants to contribute, and wants the contribution appreciated. He wants and needs Job Satisfaction and work in harmony with definite, worthwhile, stated objectives. He wants Respect for his job, no matter how insignificant the job may be; the mere fact that the job needs doing makes it important and worthy of respect, and as long as management is paying him for performing the function it must be recognized. He wants Approbation when earned, and will not complain of the discipline, if deserved. The one thing he does not want is to be overlooked or treated as inconsequential; he, too, wants to belong to the club. This does not apply only to the man on the machine, but also to the man in the next office. Happiness he can find outside of working hours, but Respect, Job Importance and Recognition, those are the vital pills which transform a worker into a colleague. Possibly, if management can slightly restate the happiness theorem and satisfy more basic human needs, management's face need not wear a strained smile. Many signs are pointing to a greater managerial awareness of Worker Recognition rather than worker happiness.

Wm. J. Schleicher

Vice President & Editorial Director

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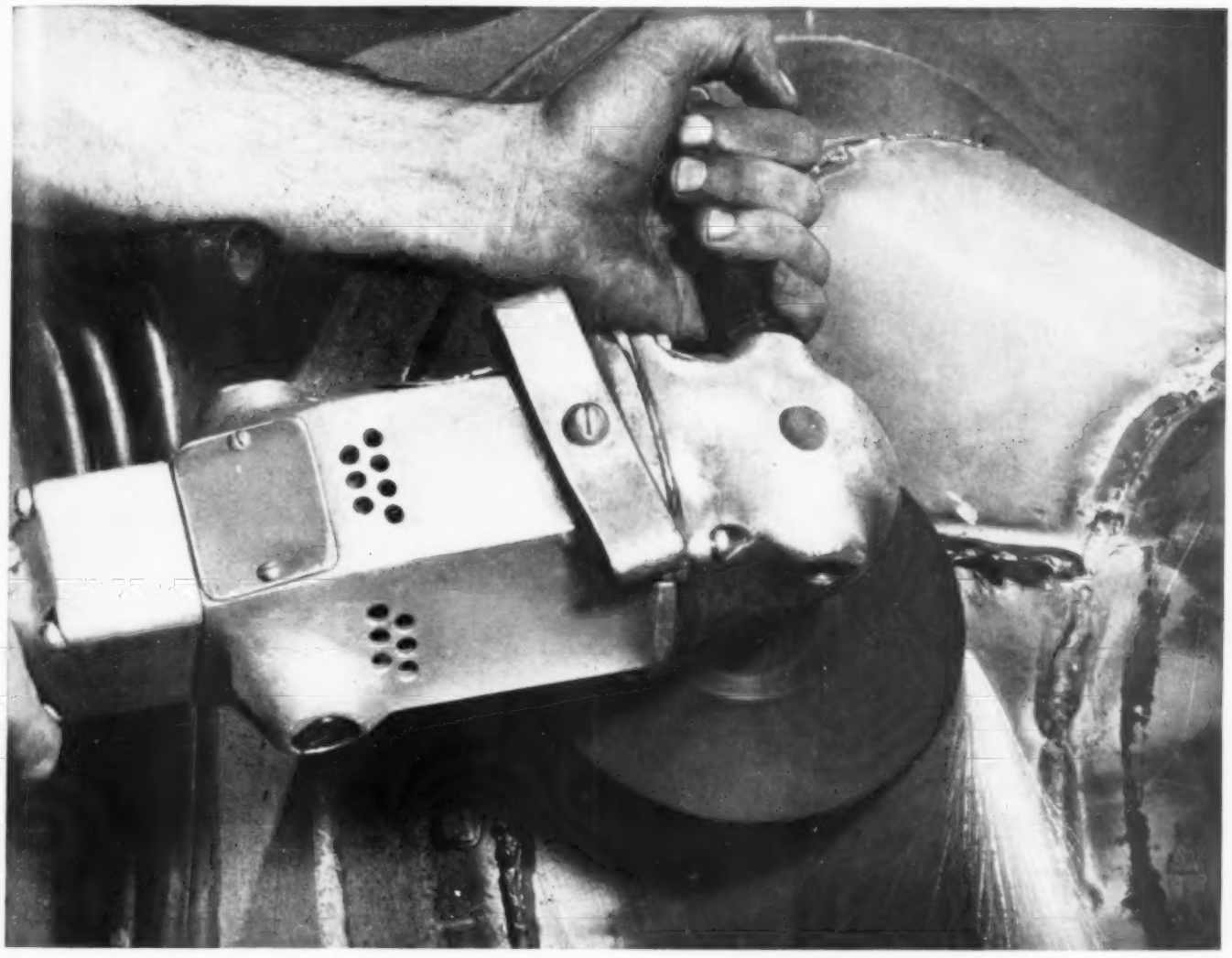

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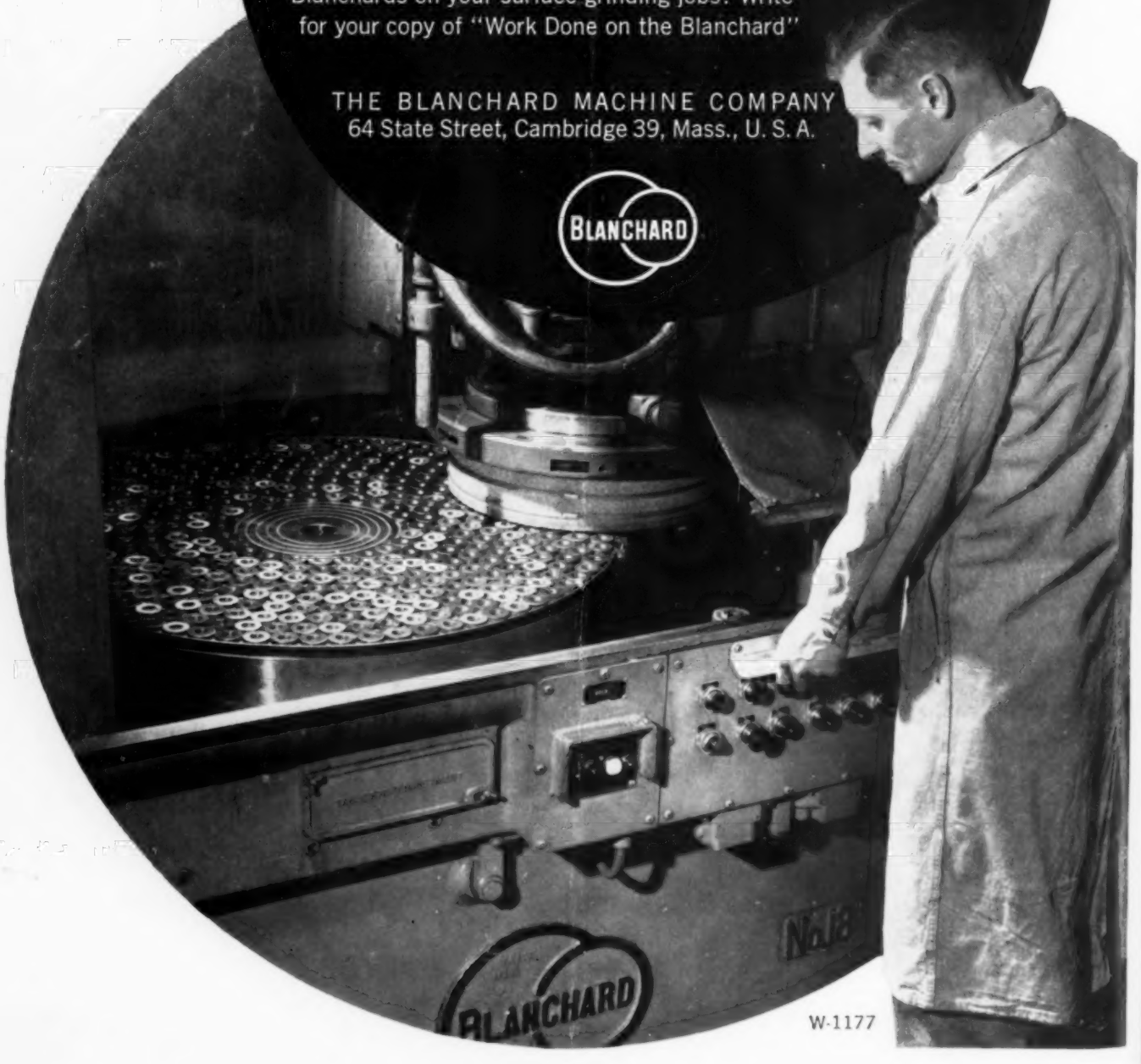

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